DISTRICT COPY

LLAGAS CREEK (REACH 2) DESIGN REPORT

(PHASE 1)

(From 1200' feet upstream of Bloomfield Rd. to 1200' upstream of Pacheco Pass Hwy.)

consisting of

PRELIMINARY DESIGN REPORT

FEBRUARY, 1982

Santa Clara Valley Water District

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
DAVIS, CALIFORNIA
MARCH 1982

DESIGN REVIEW REPORT

JOB: Llagas Creek Reach 2
PROJECT: Lower Llagas Creek Watershed Protection Project
LOCATION: Santa Clara County, California
AUTHORITY: Public Law 566 (WF-08)
PHASE: Preliminary Hydraulic Design

Summary: The water surface profiles and the channel roughness coefficients (Manning's "n") are consistent and agree with Service criteria. The concept of using a SAF type stilling basin to control a hydraulic jump meets Service criteria. The computations are preliminary and considerable refinement will need to be done during the final hydraulic design. Recommendations for the final design are included in the review comments.

Description of Job: This project consists of the hydraulic design of Reach 2 which is an approximately 14,200 feet long trapezoidal earth channel including three grade stabilization structures.

Purpose of Review: This review was made to determine compliance with standard SCS criteria and practices.

Scope of Review: The following material prepared by the Santa Clara Valley Water District was reviewed:

1. Preliminary Design Report (Phase 1)

2. Llagas Creek Reach 2 Land Rights Work Map

Basis for Review: The following reference material was used in conducting this review:

1. Far West States - Engineering Design Standards

2. National Engineering Handbook, Section 5, Hydraulics

3. National Engineering Handbook, Section 14, Chute Spillways

4. Technical Release No. 25, Design of Open Channels

5. Transactions of ASCE Vol. 113 1948, Paper No. 2342 Development and Hydraulic Design, Saint Anthony Fall (SAF) Stilling Basin

6. Engineering Monograph No. 25 USDI Bureau of Reclamation

Review Comments:

Manning's "n" Values - The use of n=.025 for bare earth channel to check channel stability at the ten percent flow is correct for bare earth areas only. Where there is rock riprap erosion protection an appropriate "n" value for the rock should be used.

Channel Stability - The narrative on page 5 of Section C states that the earth channel is stable. Whereas the computations and the typical channel cross sections show rock riprap is needed for slope protection.

Channel Stability should be determined reach by reach using the representative soil for each reach. Average soil parameters should not be used. The actual computed water depth and velocity should be used when checking for channel stability.

Use Figure 6-1 on page 6.2 of TR-25 to determine acceptable method of evaluating channel stability. The b/d ratio is not a determining factor.

Water Surface Profile - The computations are adequate except within the transitions from the earth channel to the grade control structures. The maximum change in velocity head should not exceed 20% for the standard step method. Shorter reaches and expansion or contraction headloss coefficients should be used. Also bridge pier losses should be considered if there are any piers.

Concrete Drop Structures - The use of a SAF stilling basin to control a hydraulic jump meets Service criteria. The computations in the report are preliminary and we have the following recommendations for the final design.

1. The flow depths used to size the structures should be the actual depths calculated from the water surface profiles.

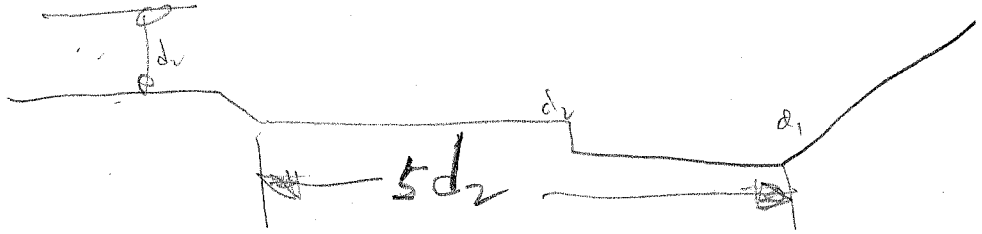
2. If possible, the three structures should be identical to save design time, reduce construction costs, and to simplify the construction drawings.

3. The bottom of the stilling basin should be level with or below the low flow channel invert elevation.

4. The chute should be designed with a vertical curve $(Y = - g x^2/2 (1.5 V)^2)$ to ensure positive pressures on the invert.

5. The end sill height should be limited to the design height with the remaining portion of the abrupt rise moved downstream so that the total lenght of stilling basin is equal to 5 d_2. This is to ensure that the SAF stilling basin will operate as modeled.

6. The baffle piers should be omitted and the chute blocks installed similar to Basin IV as shown in Engineering Monograph No. 25, summary of Stilling Basin Characteristics (copy attached)



7. The length and slope of the chute should be set for economy and hydraulic performance and should not be limited by the requirements of the fish ladder.

8. The use of a Denil fish ladder should be checked out with the biologists for proper sizing for the low base flows that will exist in the low flow channel.

John W. Hanes
Submitted

Charles D. Davis
Recommended

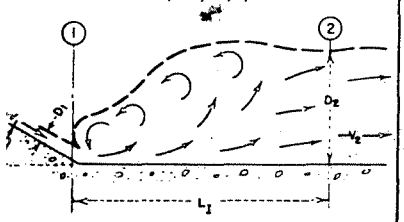
D. L. Gurley
Approved

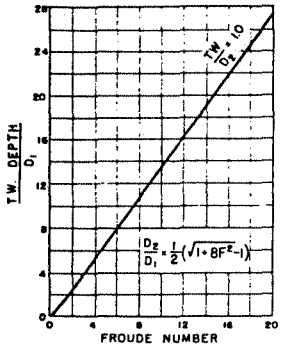
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Date

Engineering Monograph No. 25
USDI Bureau of Reclamation

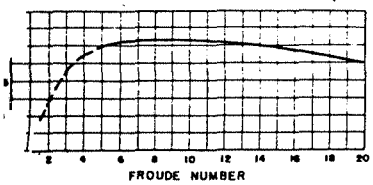
SECTION 1
GENERAL INVESTIGATION OF THE HYDRAULIC JUMP ON HORIZONTAL APRONS (BASIN I)

) occurs on flat floor with no chute blocks, baffle piers or end sill in basin. Usually not a practical basin because of excessive length. lements and characteristics of jumps for mplete range of Froude numbers is termined to aid designers in selecting more actical basins II, III, IV, V, and VI.

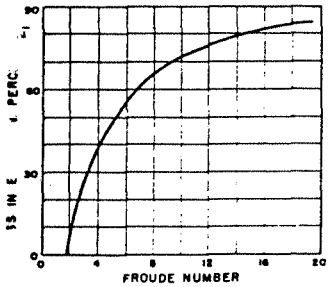




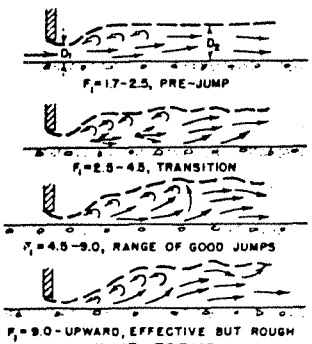
RATIO OF TW DEPTH TO D_1



LENGTH OF JUMP



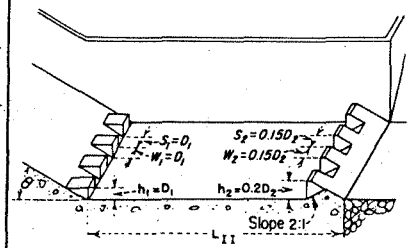
LOSS OF ENERGY IN JUMP

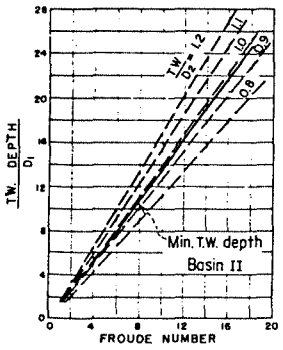


JUMP FORMS

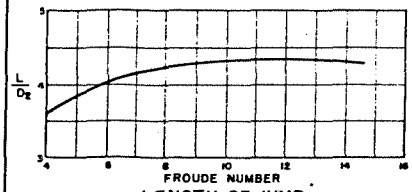
SECTION 2
STILLING BASIN FOR HIGH DAM AND EARTH DAM SPILLWAYS AND LARGE CANAL STRUCTURES (BASIN II)

Jump and basin length reduced about 33 percent with chute blocks and dentated end sill.
For use on high spillways, large canal structures, etc. for Froude numbers above 4.5.

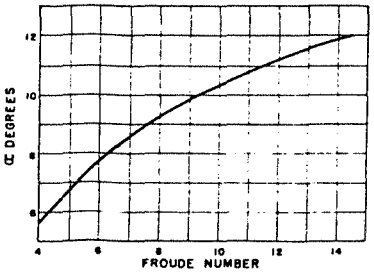


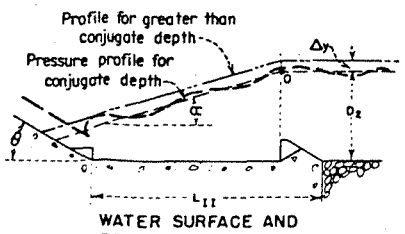


MINIMUM TW DEPTHS (SWEEPOUT)



LENGTH OF JUMP

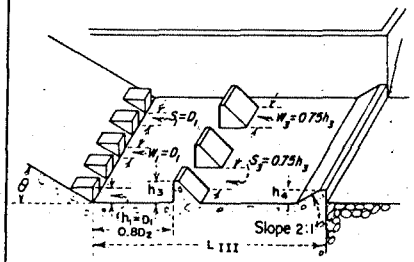


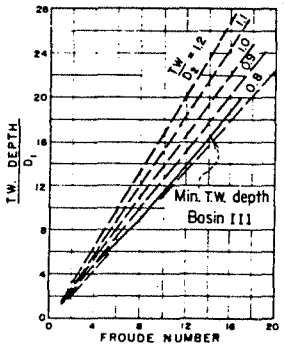


WATER SURFACE AND PRESSURE PROFILES

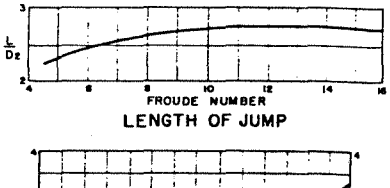
SECTION 3
SHORT STILLING BASINS FOR CANAL STRUCTURES, SMALL OUTLET WORKS AND SMALL SPILLWAYS (BASIN III)

Jump and basin length reduced about 60 percent with chute blocks, baffle piers, and solid end sill.
For use on small spillways, outlet works, small canal structures where V_1 does not exceed 50-60 feet per second and Froude number is above 4.5.

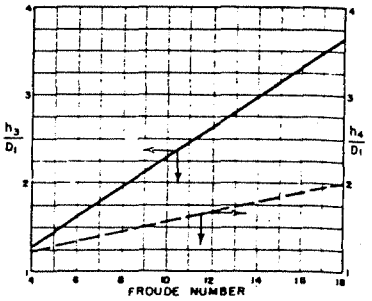




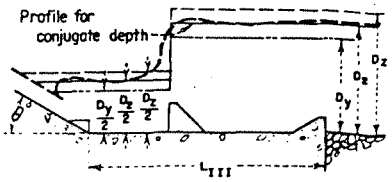
MINIMUM TW DEPTHS (SWEEPOUT)



LENGTH OF JUMP



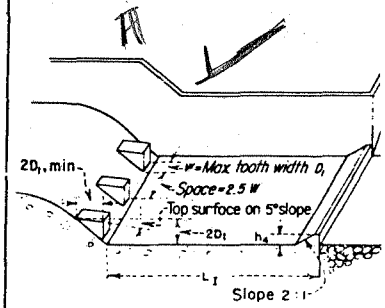
HEIGHT OF BAFFLE BLOCKS AND END SILLS

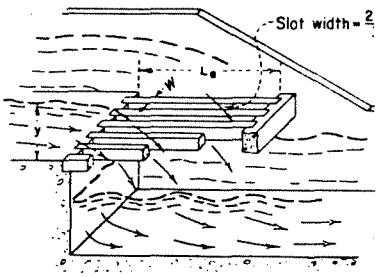


WATER SURFACE AND PRESSURE PROFILES

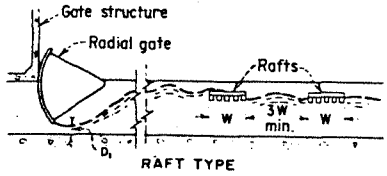
SECTION 4
STILLING BASIN DESIGN AND WAVE SUPRESSORS FOR CANAL STRUCTURES, OUTLET WORK AND DIVERSION DAMS (BASIN IV)

For use with jumps of Froude number 2 to 4.5 which usually occur on canal structures and diversion dams. This basin reduces excessive waves created in imperfect jumps.
May also use alternate design and/or wave suppressors shown below, or Basin VI

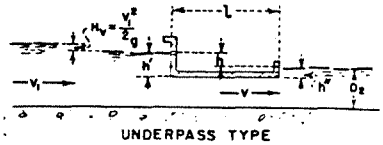




ALTERNATIVE DESIGN

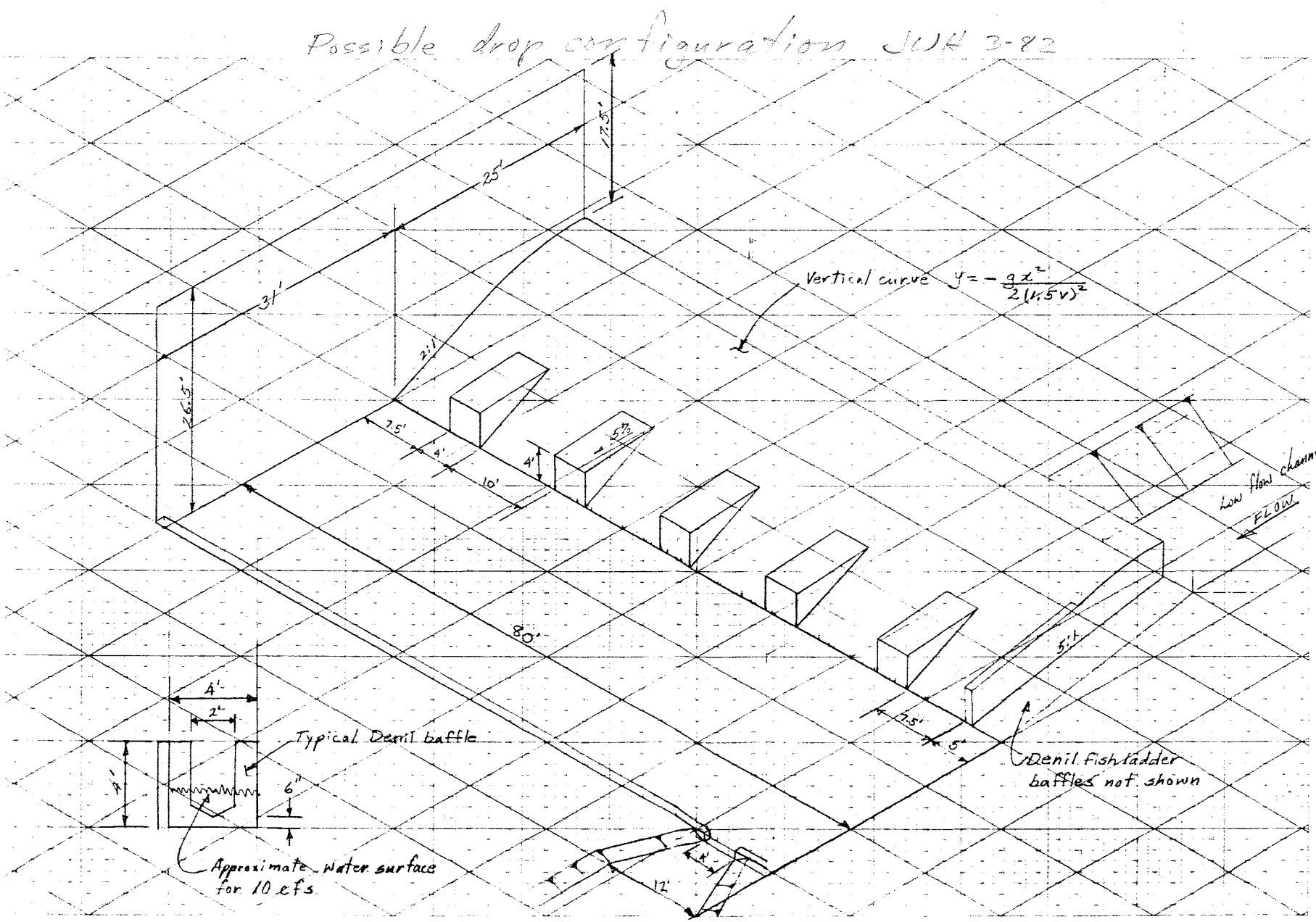


RAFT TYPE



UNDERPASS TYPE
WAVE SUPPRESSORS

SUMMARY OF STILLING BASIN CHARACTERISTICS
SECTIONS I THROUGH 4


Possible drop configuration JWK 3-82
17.5'
25'
31'
26.5'
2:1
7.5'
4'
10'
4'
5:1
Vertical curve $y = -\frac{gx^2}{2(1.5v)^2}$
Low flow channel
FLOW
80'
5:1
7.5'
5'
Denil fishladder
baffles not shown
4'
2'
Typical Denil baffle
4'
6"
Approximate water surface
for 10 cfs
4'
12'

47 4030

United States Department of Agriculture

Soil Conservation Service

2828 Chiles Road
Davis, CA
95616

(916) 758- 2200

March 16, 1982

Mr. Bruce Wilson, Division Engineer
Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118

Dear Bruce:

Subject: Reach 2 - Llagas Creek Watershed Project

We have completed the preliminary design review. Enclosed is a copy of our design review report and redlined copies of your design report and drawings.

The landrights work map seems in good order. We need to add an index of apparent property owners and an index of permits required. A sample is enclosed.

We concur with your suggestion that our staff prepare the revegetation plans and specifications.

Your soils testing (Phase 2 of Engineering Services) should be completed prior to doing the final hydraulic design and the structural design of the drop structures.

Sincerely,

JOHN W. HANES, CE
Government Representative

cc: Charles Davis, SCS, Davis (w/o enclosures)
O. T. Gerbaz, SCS, Davis (w/o enclosures)

BID SCHEDULE

LLAGAS CREEK REACH 2A
UNIT 1

ITEM NO.	WORK OR MATERIAL	SPEC. NO.	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT
1.	Mobilization	8	JOB	L.S.	XXXXX	$ ~~150,000~~ 107,000
2.	Clearing & Grubbing	2	JOB	L.S.	XXXXX	$ 116,800
3.	Structure Removal	3	JOB	L.S.	XXXXX	$ 7,500
4.	Pollution Control	5	JOB	L.S.	XXXXX	$ 21,000
5.	Removal of Water	11	JOB	L.S.	XXXXX	$ ~~15,000~~ 85,000
6.	Common Evcavation	21	372,800	C.Y.	$ 0.90	$ 335,520
7.	Channel Fill	23	0	C.Y.	$ 1.25	$ 0
8.	Dike Fill	23	389,850	C.Y.	$ 1.25	$ 478,312
9.	Filter Material	24	1800	C.Y.	$ 15	$ 27,000
10.	Loose Rock Riprap	61	5000	TON	$ 35	$ 175,000
11.	Grouted Rock Riprap	62	4640	TON	$ 40	$ 185,600
12.	Grout	62	870	C.Y.	$ 50	$ 43,500
13.	Metal Plates	81	4	EA.	$ 1,000	$ 4,000
14.	Side Inlets	51	5	EA.	2,000	$ 10,000
15.	Vegetative Cover	6	64	A.C.	$ 2,000	$ 128,000

$ 1,102,000

TC425L52D471982c.1

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SAN JOSE, CALIFORNIA 95118

SANTA CLARA VALLEY WATER DISTRICT

Design Report - Phase I

for

LOWER LLAGAS CREEK, REACH 2
(From 1,200 feet upstream of
Bloomfield Road to 1,200 feet upstream
of Pacheco Pass Highway)

Project No. 5028

Report prepared by Special Project Division Staff

Timmy Yung, P.E.
Associate Civil Engineer

Under the Direction of

Bruce Wilson
Division Engineer
Special Projects Division

George Korbay
Flood Control Manager

John T. O'Halloran
General Manager

FEBRUARY 1982

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SECTION A. INTRODUCTION

This is the Phase I report for work accomplished in accordance with the Engineering Services Agreement No. 59-9104-9-178, executed on May 22, 1979, between the Soil Conservation Service and the Santa Clara Valley Water District. The Plan of Operations was amended on January 21, 1982. The Agreement calls for the District to prepare Plans and Specifications for construction Reach 2 of Lower Llagas Creek between 1,200 feet upstream of Bloomfield Road and Pacheco Pass Highway. The design is to be completed in five phases. The scope of the Agreement covers topographic surveys and aerial photography, geotechnical investigation and soils testing, preliminary hydraulic design, final hydraulic deisgn, final channel design, plans and specifications, and estimates.

This Phase I report is divided into nine sections, consisting of a general description together with basic design criteria, procedure and assumptions, a brief description of the HEC-2 water surface profiles computer program written by the U.S. Army Corps of Engineers, and a preliminary landscaping and maintenance program.

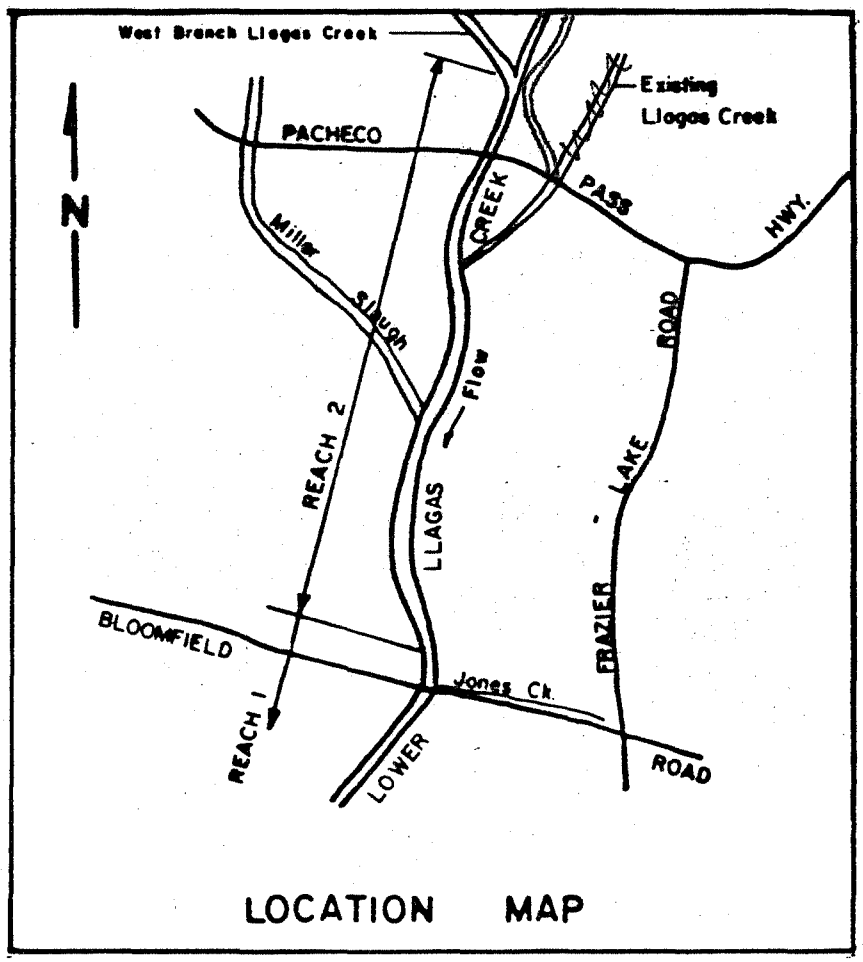
PROJECT
DESCRIPTION B

SECTION B. PROJECT DESCRIPTION

The project site is Lower Llagas Creek, Reach 2, from 1,200 feet upstream of Bloomfield Road to 1,200 upstream of Pacheco Pass Highway (State Route 152) in the City of Gilroy (see Figure 1 for location map). Reach 2 is approximately 14,200 feet long of which approximately 3,000 feet of existing bank on one side and another 3,000 feet of the creek on the other side will be preserved.

The proposed work consists of excavating, disposing and placing into levees earth material, constructing three grade stabilization (drop) structures, replacing one existing farm bridge, ~~planting approximately 2,500 shrubs~~, groundcover plants, and trees along the main channel within the freeboard area, providing drainage inlets with gates, replacing existing fencing, water supply lines, and constructing other appurtenances, facilities and auxiliary work required to complete flood control measures on Reach 2.

The proposed project is one of a series of steps to provide flood damage reduction in the Llagas Creek Watershed as described in the draft Environmental Impact Statement and the Engineering Appendix for Upper and Lower Llagas Creek. The project will protect primarily existing agricultural land within the floodplain from the one percent chance (100-year) event and will provide an adequate outfall for the Cities of Gilroy and Morgan Hill.



LOCATION MAP

LLAGAS CREEK
REACH 2

FIG. 1

PRELIMINARY
CHANNEL DESIGN C

SECTION C. PRELIMINARY CHANNEL DESIGN

History of Reach 1

During periods of high runoff, Pajaro River overflows its banks in the South Santa Clara Valley floor and combines with floodwaters from Llagas and Carnadero Creeks to form "Soap Lake". Soap Lake covers a large farm land area which is frequently inundated to depths that vary with the flood magnitude.

Reach 1 begins at the confluence of Llagas Creek and the Pajaro River and extends upstream to a point about 1,200 feet upstream of Bloomfield Road. The improvements to Reach 1 were constructed in 1973 by SCS and included the excavation of the creek bed, reconstruction of the levees, installation of inlet structures and placement of riprap. Reach 1 was designed for a ten percent flood between Pajaro River and a point 2,000 feet upstream, for a four percent flood between this point and Bloomfield Road, and a two percent flood between Bloomfield Road and a point 1,700 feet upstream. The levees on Reach 1 have consolidated between one to two feet. Excess material from Reach 2 will be used to raise these levees at least to their original elevation.

The hydraulic control for the water surface profile computed for Reach 1 was based on the corresponding frequency of the lake level.

The bridge at Bloomfield Road was not replaced as part of the Reach 1 project and remains inadequate to pass the one percent flow. Since the bridge deck and the two road approaches are inundated under the one percent flood, there would be no advantage to raising the bridge to pass the one percent flood flow. However, the final Engineering Appendix requires that the inadequate bridge be replaced to provide a channel capacity equal to the upstream and downstream channel. The replacement of the Bloomfield Road bridge is a "local" responsibility and is not a part of the subject project. Presently the existing channel capacity for Reach 1 is approximately 13,000 cfs. Therefore, Reach 2 will start where Reach 1 left off; 1,700 feet upstream of Bloomfield Road.

Design Criteria - Reach 2

This section will describe the basic design criteria used for this project, and the structural elements which will be included. The design of this project was based generally on S.C.S. criteria for flood control projects. The principal criteria used in the design of the project involves the following parameters: 1) flow rates, 2) channel roughness, 3) allowable flow velocities for erosion control, 4) freeboard, 5) structural elements, and 6) miscellaneous criteria. The criteria used in each of these categories are as follows:

1. Flow Rates - Figure 1 summarizes the flow rate for the 100-year flow and 10-year flow after the project is built. These flow rates correspond to various locations along Llagas Creek as indicated in the following table. The entire Reach 2 will be constructed to the 100-year flow capacity.

FIGURE 1

Location	*100-Year Flow	*50 Year Flow	*10 Year Flow
C_L Station 22+00 to C_L Station 54+00	18,800	16,500	11,000
C_L Station 54+00 to C_L Station 91+00	18,300	15,900	10,700
C_L Station 91+00 to C_L Station 152+40	17,800	15,400	10,400

The stationing used in the construction plans is not the same stationing shown in the Work Plan Engineering Appendices dated April, 1966. Figure 2 shows the correlation between the two sets of stationing.

FIGURE 2

Engineering Appendix Stationing (Approx. Stationing)	Santa Clara Valley Water District Stationing	Comments
49+00 (+)	10+10	Bloomfield Road Bridge
60+40 (+)	22+00	Begin Reach 2 Project
93+40 (+)	54+00	
126+55 (+)	89+00	New Farm Bridge Location
133+55 (+)	95+35	New Drop Structure
174+00 (+)	132+00	New Drop Structure
182+00 (+)	139+00	Pacheco Pass Highway
185+00 (+)	142+00	New Drop Structure

* These design discharges were computed by the Santa Clara Valley Water District Section I, Item 6 for reference)

2. Channel Roughness Coefficients - The following table summarizes the channel roughness coefficients for design flow rates.

1. n = .069 vegetated earth channel, one bank untouched at one percent flow.

2. n = .063 vegetated earth channel, at one percent flow.

3. n = .025 bare earth channel, for erosion control at ten percent flow.

Channel roughness coefficients calculations were based on design ~~data~~ criteria provided in the Soil Conservation Service's ~~NH~~ NEH 5 Supplement B.

3. Allowable Flow Velocities - The design channel cross-section, profile, and structural elements were selected to provide flow conditions which would result in minimum channel erosion. To evaluate the achievement of this objective, it was assumed that maximum streamflow velocities during the 100-year or one percent flood should not exceed six fps (feet per second). The average computed channel velocity is about 5 fps. To verify the stability of the channel, the tractive power method was used to determine the allowable velocity. Soil data was provided by the Soil Conservation Service. The tractive power analysis shows that the erosive resistance of the material in the channel boundary is good enough to provide an acceptable factor of safety. Also, stability of the channel bed and bank will be further verified by a supplemental soils report. A minimum velocity of two fps was maintained to ~~avoid~~ reduce silting and deposition.

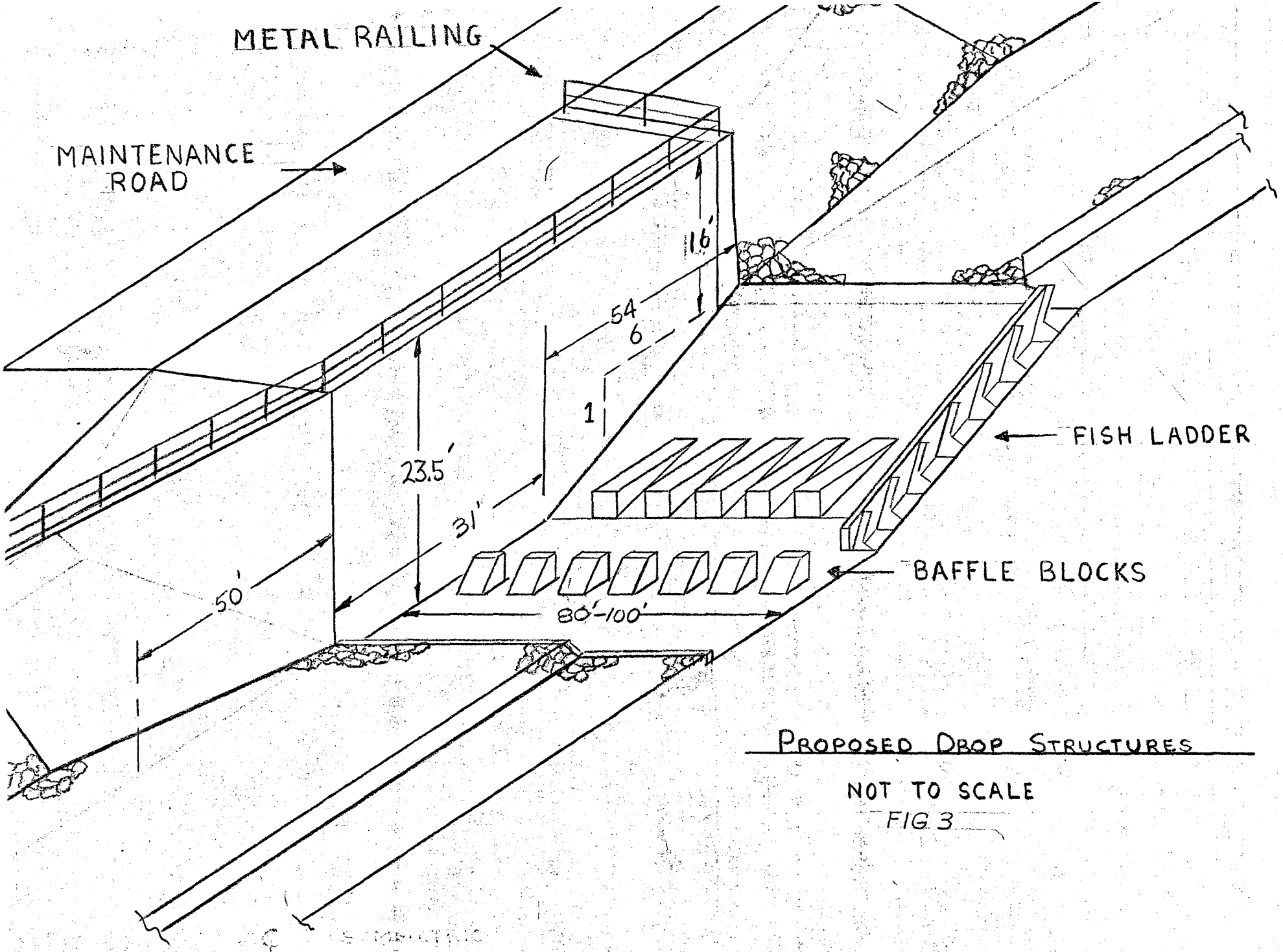
4. Freeboard - The freeboard height was computed at 0.2 times specific energy. Where new bridges were being proposed, a minimum of one foot of freeboard will be provided below the bridge soffit for design flow conditions. Freeboard requirements were based on design standards provided in the Soil Conservation Service's Engineering Design Standard, Far West States.

5. Structural Elements - Three new reinforced concrete grade stabilization structures (drop structures) are to be constructed. They will be at Stations 95+35, 132+00, and 142+00 (see Figure 3). The drop structures are required to maintain the small channel slope and the associated nonerosive flow rates.

The structural configuration was selected after considering several alternatives. Comparison of each alternative with respect to economic and environmental criteria led to the choice of a straight chute inlet with a SAF (Saint Anthony Falls) type stilling basin. Among the alternatives considered, but not selected, were several box inlet-type drop structures, a rock-lined chute section, submerged bucket dissipators, and several Bureau of Reclamation stilling basins.

The SAF stilling basin and straight chute inlet combination, as designed, will effectively dissipate, in a nonerosive manner, the energy associated with the design flow falling five feet. The chute and basin will be approximately thirty-one feet-long and 80 feet-wide. Backfilled vertical concrete sidewalls extend above the design water elevation throughout the structure. Rock lining will be provided upstream and downstream of the structure to prevent localized scour and erosion.

A Denil Fishway-type fish ladder has been included in the design. (See Figure 3A for the Dryden Dam Denil Fish Ladder). The fish ladder is to be located on one side of the straight chute. Water will be diverted into the fish ladder via the low flow channel providing a fishway at essentially all times. The fish ladder will spill into the stilling basin, where a shallow pool about three and one-half feet-deep will form and serve as a resting place. Because the fish ladder is small in comparison to the overall structure, it was assumed to have a negligible effect on the hydraulics of the drop structure.



PROPOSED DROP STRUCTURES

NOT TO SCALE

FIG 3

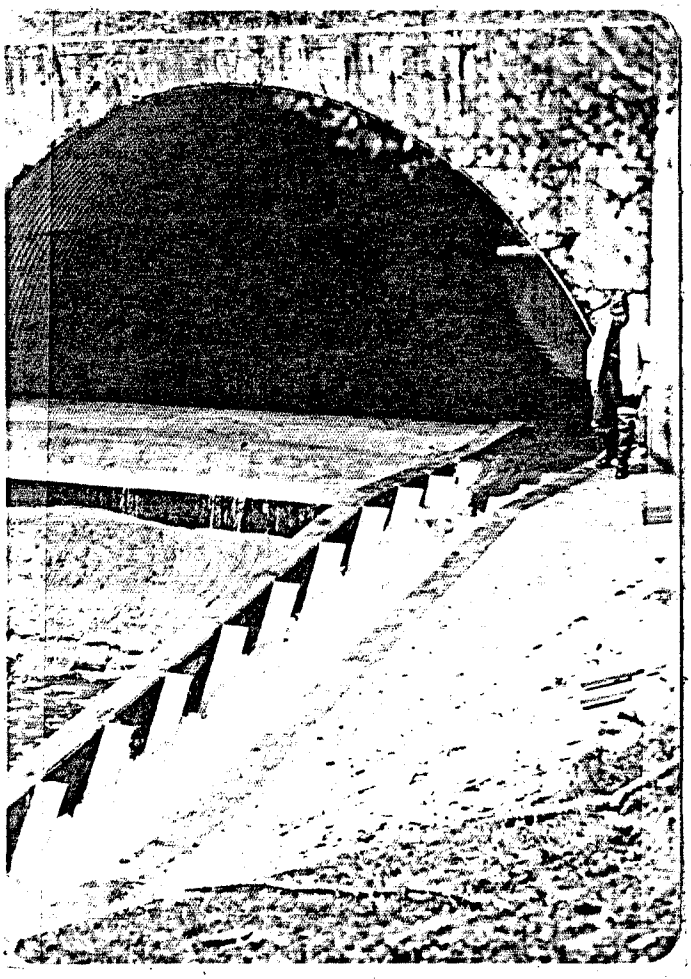


FIG 3A

DENIL FISHLADDER

6. Miscellaneous Criteria - Numerous miscellaneous construction items in addition to the elements previously discussed will be included in this project. Twelve new local drainage inlets will be provided to control storm runoff from adjacent lands. Fencing will be installed where necessary to replace existing private fences which must be removed. Several existing drainage and diversion facilities will be modified to conform to the new construction. A special inlet structure will be designed for Miller Slough. In addition to the flood control measures included in this project, a new farm bridge will be designed and constructed. The Plans and Specifications will also include mandatory disposal sites for excess material from excavation. A tentative site has been selected for disposal of most of the excess material. The City of Gilroy would like to have their existing pond levees reinforced with additional fill. As part of this project a suitable percolation pond will have to be constructed to replace portions of Gilroy's wastewater treatment ponds that will be taken as part of the flood control project. This pond will require between 20 and 25 acres.

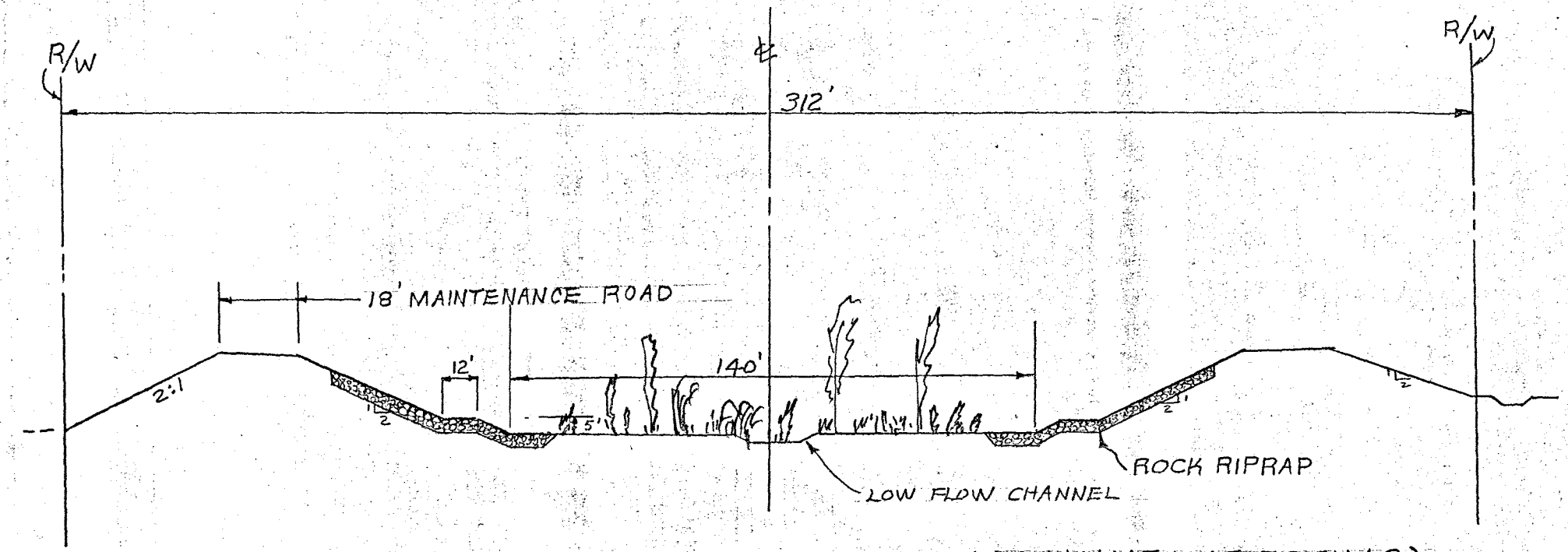
SECTION D. DESIGN PROCEDURES AND ASSUMPTIONS

The hydraulic design is generally in accordance with Section IV of the Engineering Appendix to Work Plan Supplement, January 10, 1977, and the Engineering Appendix Supplement of January 1982.

To design Reach 2 channel, considerable effort was spent in reevaluating the Manning's "n" value. The original planning for Reach 1 and Reach 2 did not reflect consideration for anticipated future vegetation and maintenance. The original "Work Plan" (1977) channel cross sections were based upon a Mannings's "n" of .035 for an unlined cleared out channel (see Figure 4 for typical Reach 1 cross section). However, water from Pajaro River, combined with groundwater and local drainage is present in the channel bottom of Reach 1 for most of the year. The presence of this water has allowed the growth of a lush riparian habitat. This vegetation causes an "n" value of .075. Therefore, Manning's "n" value in the original 1979 Engineering Appendix is too low in light of both the expected future vegetation in the creek and the proposed future maintenance requested by the Department of Fish and Game and the Federal Fish and Wildlife Service. It was recommended, and subsequently approved by the Soil Conservation Service Project Office, that the final design be based on the higher channel roughness coefficients for Reach 2 (see Section H, Design Calculations). Figure 5 consists of four sheets and shows the typical channel sections for Reach 2 before vegetation is established.

NEH
~~NH~~5 Supplement B was used as a reference for finding the most appropriate "n" value.

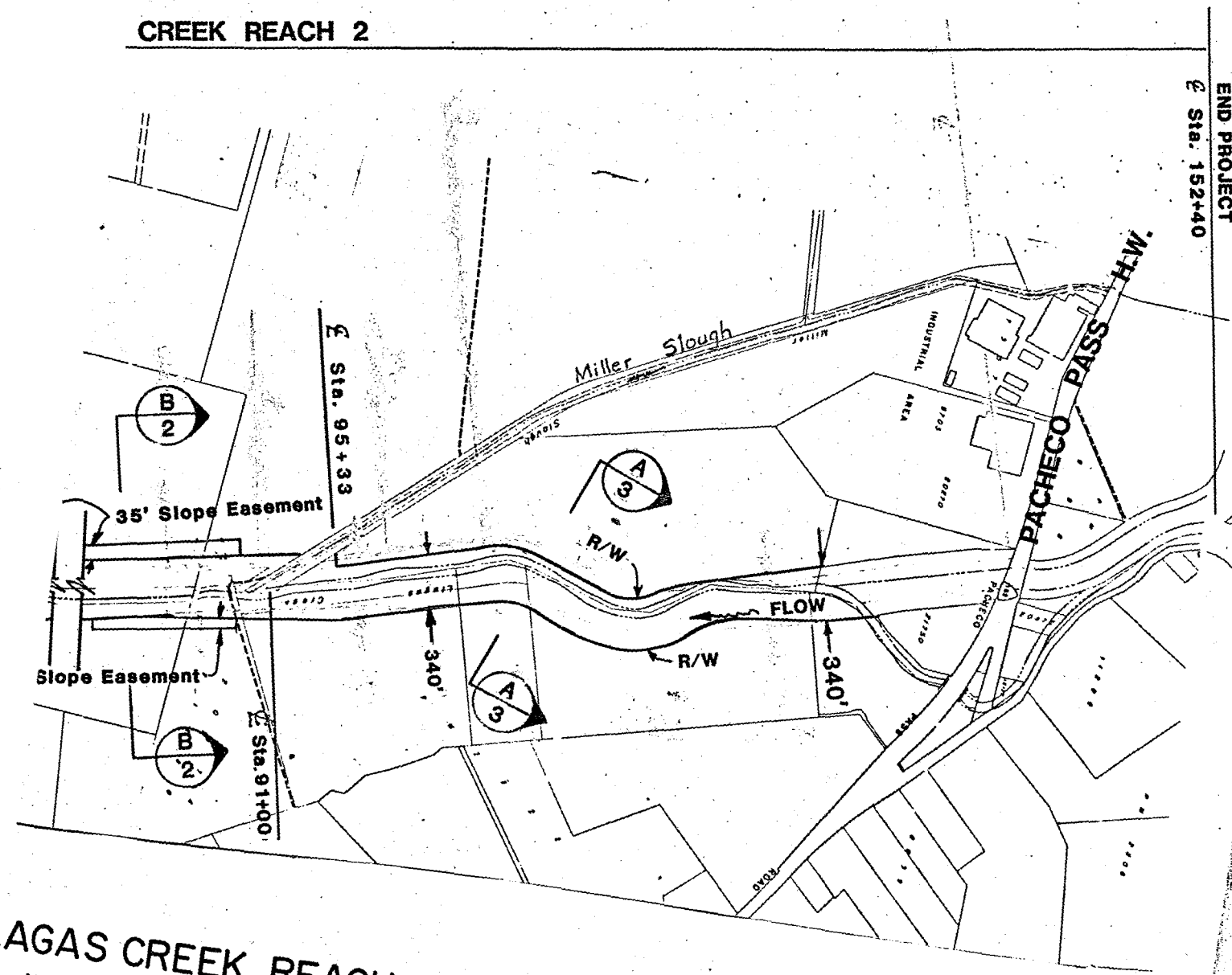
As a result of an increased "n" value from .035 to.063, the present channel at Reach 1 which was designed and constructed for the two percent event is inadequate to handle flows even more frequent than the 15-year flood. Water will break over the existing Reach 1 levees. The existing levees between Bloomfield Road and the upstream end of Reach 1 (Station 22+00) should be protected with rock lining or some other type of erosion protection, especially on the back slopes, as part of the Reach 2 channel work.



TYPICAL REACH 1 CHANNEL (EXISTING)

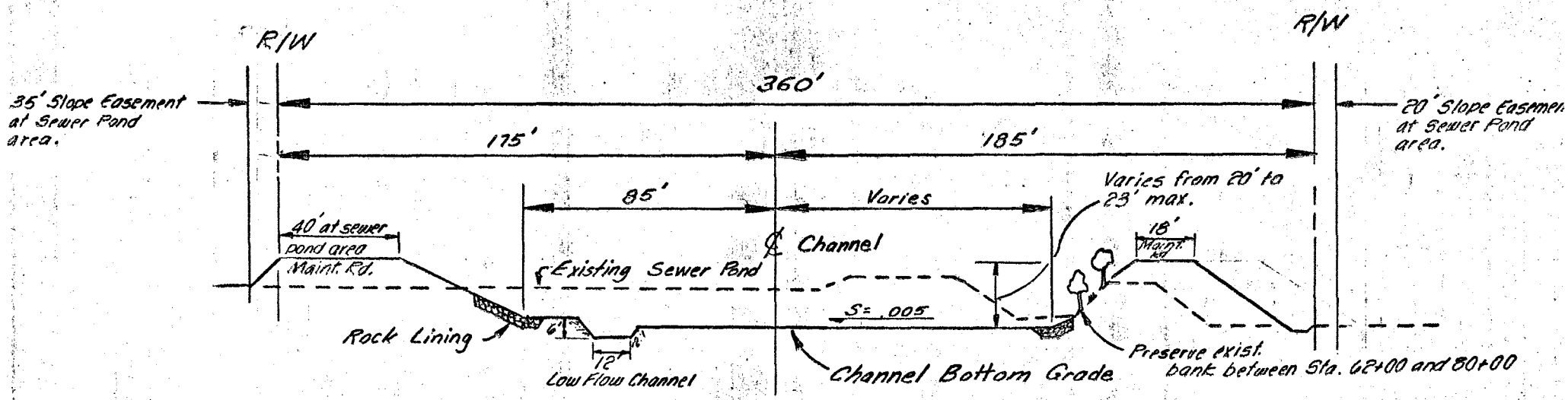
N.T.S.

FIG. 4

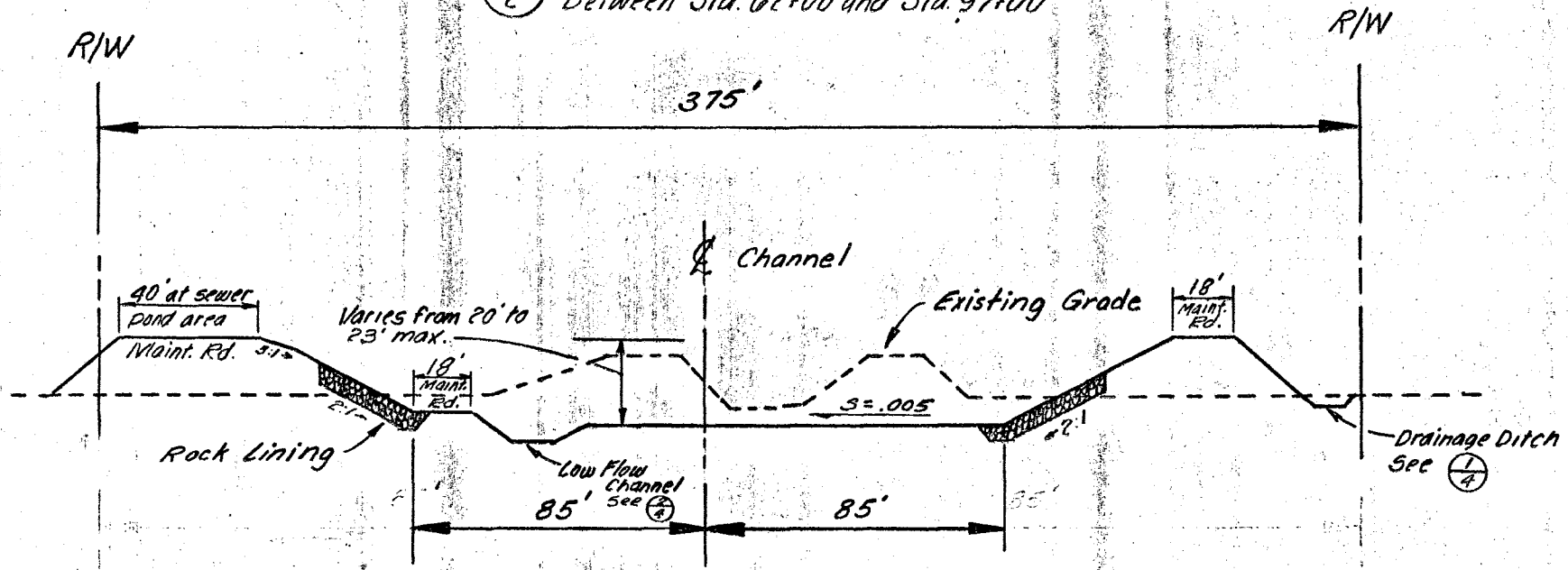


AGAS CREEK REACH 2

NOT TO SCALE

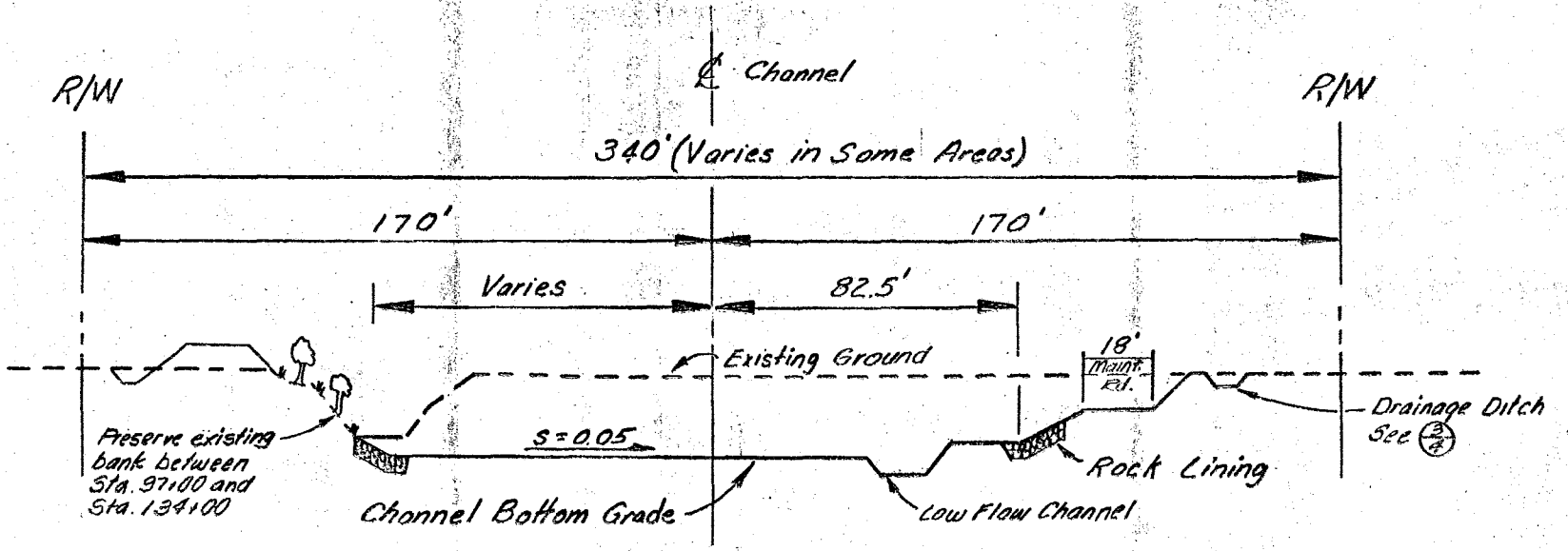


B/2 Typical Channel Cross Section Between Sta. 62+00 and Sta. 97+00



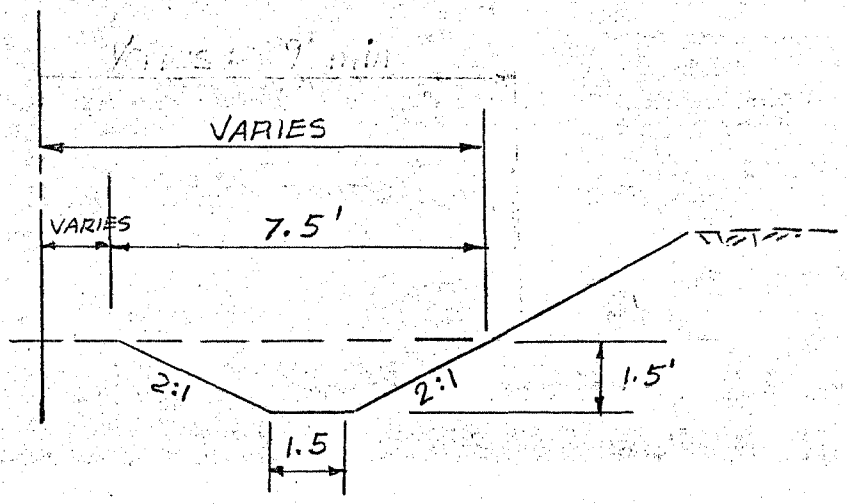
A/2 Typical Channel Cross Section (Future vegetation not shown)

FIGURE 5 (cont.)
SHEET 2 OF 4



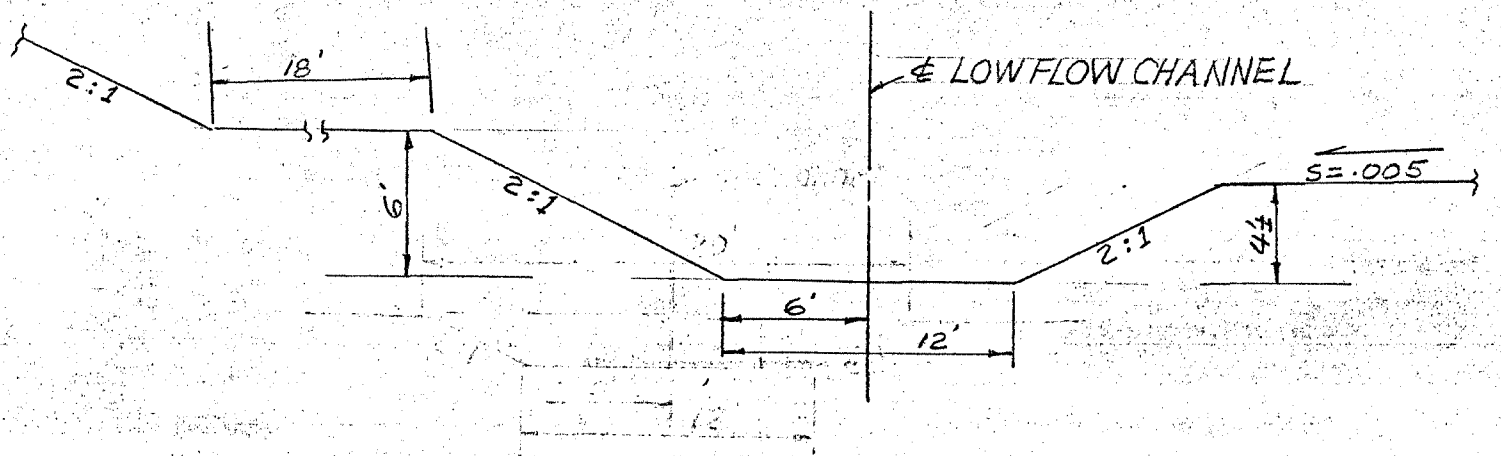
(A/3) Typical Channel Cross Section
Preservation of One Bank
Between Sta. 97+00 and Sta. 152+00

FIGURE 5 (cont.)
SHEET 3 OF 4



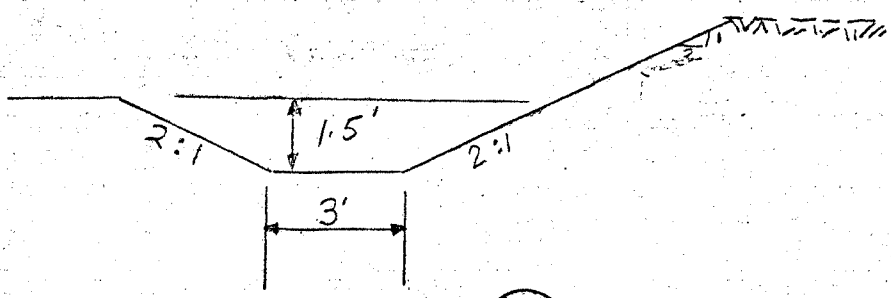
DETAIL (1/4)

SCALE 1" = 4'



DETAIL (2/4)

SCALE 1" = 8'



DETAIL (3/4)

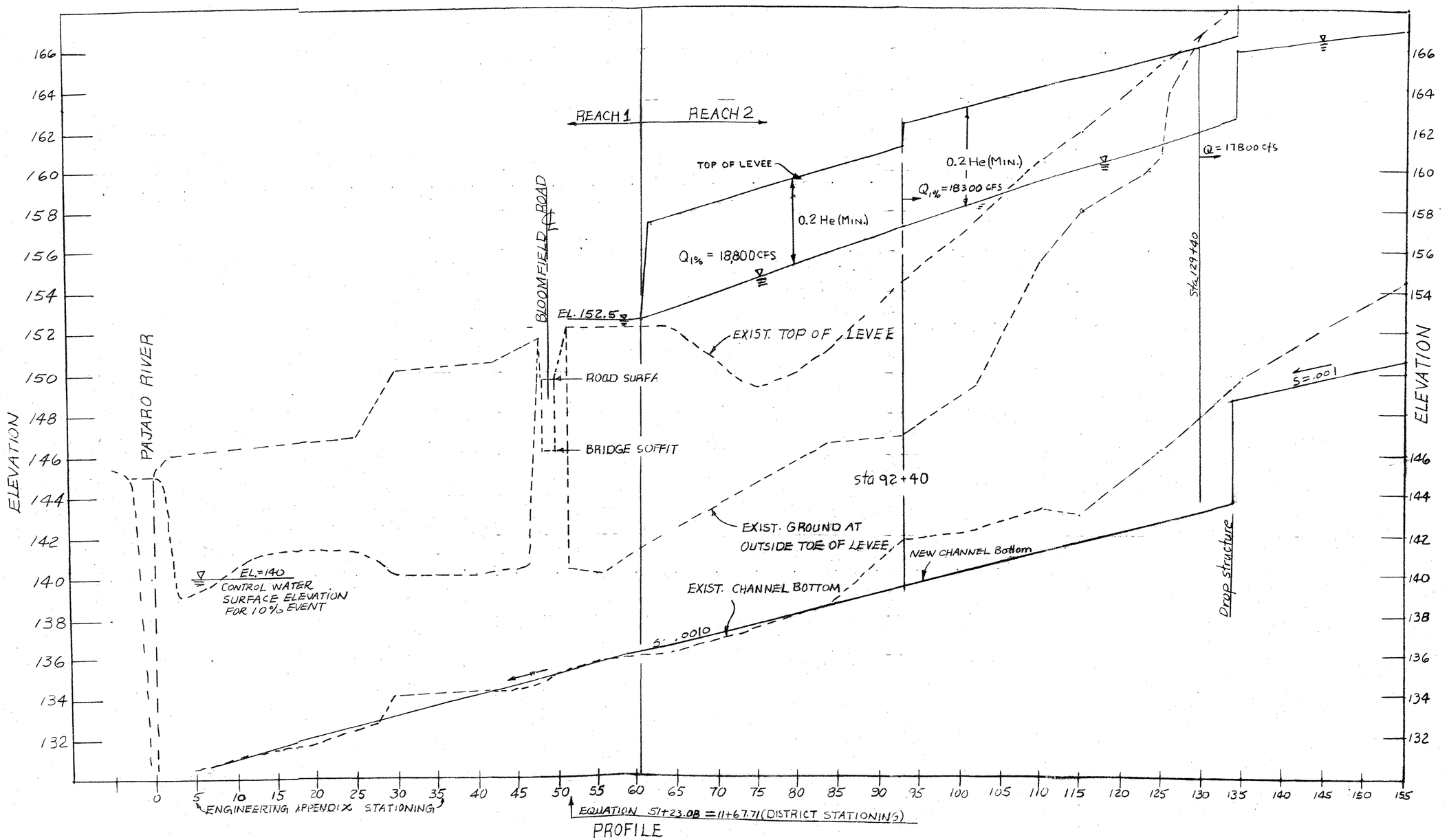
SCALE 1" = 4'

FIGURE 5 (cont.)
SHEET 4 OF 4

The hydraulic control for Reach 2 is at Station 22+00 (Engineering Appendix Station 64+00) at a water surface elevation 152.5 feet where water starts to break over the existing Reach 1 levees. The original intention in the work plan was to use the one percent water surface elevation in "Soap Lake" as the control for the one percent flood flow in Lower Llagas Creek. However, for the new "n" value of .063 the water surface would rise rapidly above the existing levee by the time the water surface profile is run back to Station 22+00. Since the channel between Bloomfield Road and Station 22+00 has already been built as part of Reach 1, it is not desirable to go back and raise these levees except for the raising needed to account for consolidation. Since "Soap Lake" surrounds the levees at elevation 146.5 feet for the one percent lake elevation which occurs simultaneously with the one percent discharge in Lower Llagas Creek, there is no advantage to outfalling water from Lower Llagas Creek any further downstream than Station 22+00. Water surface profiles were also run for the two percent flood in Llagas Creek, using the two percent elevation in "Soap Lake" (144 feet) and showed that the water surface would still be several feet above the existing levees at Station 22+00. Therefore, it is reasonable to assume that the hydraulic control for Reach 2 and for the one percent and two percent flows are at a water surface elevation 152.5 feet at Station 22+00 where water will start to break over the levees (see Figure 6 for profile).

Water surface profiles for 100-year, 50-year and 10-year frequency were run from downstream to upstream using the Water Surface Profiles Computer Program (HEC-2), written by the U.S. Army Corps of Engineers. Design cross section data were entered as well as channel slope, design discharge, values for Manning's "n", beginning water surface velocity, velocity head, top width of water surface and other data with which to set freeboard (see computer printout in Calculation Appendix, Section H).

The goal of the hydraulic design was to minimize the amount of the right of way but to stay within the design criteria. By varying the drop structure width, it was possible to keep velocities within the allowable limits.


REACH 1
REACH 2
TOP OF LEVEE
0.2 He (MIN.)
0.2 He (MIN.)
$Q_{1\%}$ = 18,800 CFS
$Q_{1\%}$ = 18300 CFS
Q = 17800 cfs
BLOOMFIELD ROAD
EL. 152.5
EXIST. TOP OF LEVEE
ROAD SURFA
BRIDGE SOFFIT
PAJARO RIVER
sta 129+40
sta 92+40
S=.001
EXIST. GROUND AT OUTSIDE TOE OF LEVEE
NEW CHANNEL Bottom
EXIST. CHANNEL BOTTOM
S=.0010
EL.=140
CONTROL WATER SURFACE ELEVATION FOR 10% EVENT
Drop structure
ELEVATION
ELEVATION
ENGINEERING APPENDIX STATIONING
EQUATION 51+23.08 = 11+67.71 (DISTRICT STATIONING)
PROFILE

The depth of flow produced in the design channel sections ranged from 16 feet to 19 feet and velocity heads ranged from 1 feet to 1.5 feet, respectively. Freeboard, therefore, varied from 3.5 to 4.0 feet for the design, since it is computed at 0.2 times the sum of depth and velocity head (specific energy). The typical design channel sections are shown in Section D of this report. In addtion, the channel sections immediately after construction were tested for a ten percent flood using a value of n = .025. The average velocity for the 10-year frequency is about 5 fps. Rock lining may be required at the drop structures to minimize erosion of the newly constructed channel. The need for this protective rock lining will be verified by the supplemental soil investigation.

Channel side slopes were designed to provide stability from slope failure. The design slope was based on an estimate of soil strength parameters from data provided by S.C.S. These estimates will be verified by a supplemental soils investigation to be conducted before the completion of the final phase of design. The alignment for the channel was selected to follow the existing channle alignment as closely as possible except where one bank must be saved.

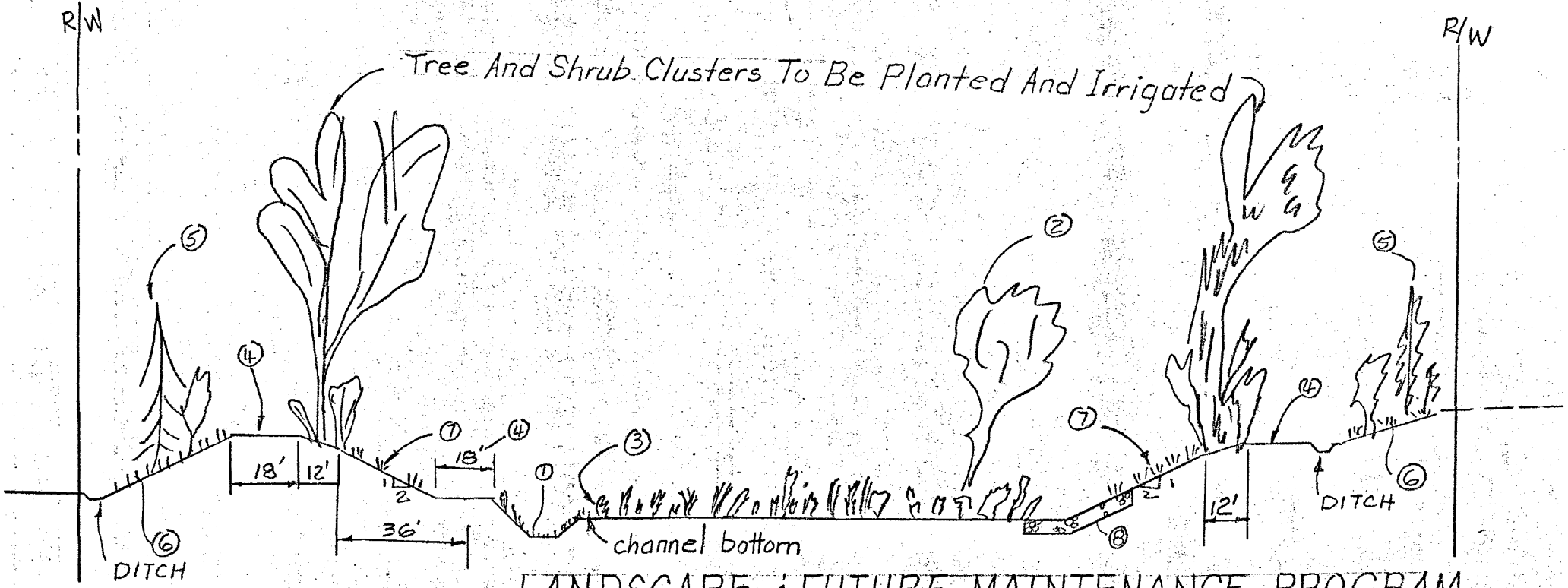
The right of way needed for Reach 2 is shown on the draft Land Rights Work Map for Reach 2. The increase in "n" value from .035 to .063 caused an increase in the amount of the right of way needed over that called for in the original Engineering Appendix. The amount of additional right of way needed varies along the reach, but it ranges between 40 feet and 80 feet.

REVEGETATION AND
MAINTENANCE E

SECTION E. REVEGETATION AND MAINTENANCE

The project requires that revegetation be provided as a mitigation measure where the proposed improvements would cause significant damage to an existing riparian community. ~~Approximately 2,500 shrubs,~~ plants and trees will be planted along Reach 2 in the freeboard area of the slopes and on the back slopes of the levees. Groundcover will be planted on the remaining side slopes. Certain freshwater marsh plants will be allowed to reestablish in the channel bottom. Plants will be primarily the native, low maintenance species with significant value as fish and wildlife habitat and aesthetic appeal. Future maintenance on Reach 2 will be limited so that the remaining vegetation appears similar to that shown in the photograph of Reach 1 below (see Figure 6A for typical vegetated cross section).





LANDSCAPE & FUTURE MAINTENANCE PROGRAM

NOT TO SCALE

NOTES:

1. Fish Run
2. Restrictive Trees And Shrubs To Be Removed Annually. Typical Varieties To Be Removed: Willows, Sycamores, Box Elders, Alders And Cottonwoods.
3. Native Riporian Vegetation Of Selected Varieties To Remain. Typical Varieties To Remain: All Fresh Water Marsh Plants.
4. Maintenance Roods To Be Kept Clear Of Vegetation And Passible At All Times.
5. Highly Drought Tolerant Trees And Shrubs On Levee Back Slopes And On Outer Cut Slopes.
6. Remove Weeds Annually Or As Required To Protect Adjacent Crops From Weed Seed.
7. Native Grasses Only On Lower 36' Of Side Slope (Not Seeded)

FIG 6A

should neither

Reach 2 should be reasonably stable several years after construction and ~~shold not~~ erode nor fill with sediment. The only maintenance that we expect within the foreseeable future in Reaches 1 and 2, except for the removal of obstructing trees and tall vegetation, is the establishment of tree and shrub clusters high on the channel side slopes and levee back slopes. Debris may have to be plucked from around the tree and shrub clusters after especially infrequent flood flows and occasionally the entire cross section may need policing of man-made garbage. Therefore, the influence of our proposed maintenance scheme on the "n" value for Reaches 1 and 2 is to keep it between .060. and .070 $\pm$.

SECTION F. COMPUTER PROGRAM HEC-2

The Hydrologic Engineering Center (HEC) has developed a large number of computer programs to aid Corps of Engineer's offices in the analysis of hydrologic engineering and planning problems. Computer program HEC-2, "Water Surface Profiles", is widely used by engineers in the public and private sectors engaged in hydrologic studies.

HEC-2 has been developed to perform steady, gradually varied flow profile computations for natural and man-made channels. The program has been designed to consider the effects of local obstructions such as weirs, culverts, bridges, and encroachments in a manner that will allow continuous (uninterrupted) profile computations. Profiles may be computed for either sub or supercritical streams. The computational procedure is based on the solution of the one-dimensional energy equation with energy loss due to friction evaluated with Manning's equation. The computational procedure is generally known as the Standard Step Method. HEC-2 is typically employed in urban watersheds to determine floodplains, floodways, and flood hazard zones, to evaluate bridges and culverts and to analyze improvements to drainage systems.

PROJECT COST G

SECTION G. PROJECT COSTS

It is estimated that the total construction cost of the Reach 2 Llagas Creek Project is about $6,703,000 at 1982 prices. This cost does not include engineering, contract administration and inspection costs, and right of way costs. The construction cost of the Reach 2 project will be borne by the Soil Conservation Service. However, the right of way, utility relocations and bridge costs will be a local cost. A detailed cost breakdown for the project, including quantities and unit prices, is presented in Section H of this report.

DESIGN
CALCULATIONS H

SECTION H. DESIGN CALCULATIONS

1. Control for one percent, two percent, and ten percent flood
2. Channel roughness coefficients and hydraulic design of drop structures
3. Computer print out for one percent, two percent, ten percent flood
4. Channel stability analysis
5. Design parameters, for concrete elements
6. Quantities and cost estimate

DATA AND
REFERENCES

CONTROL ESTIMATE FOR THE 1% and 2% flood

ESTIMATED FLOWS OVER BLOOMFIELD BRIDGE

1) ASSUME WIER FLOW WILL OCCUR OVER BLOOMFIELD BRIDGE AND OVER THE ROADWAY TO EITHER SIDE.

2) ASSUME THE HEAD ON THE WEIRS IS SLIGHTLY ABOVE EL 152 AS SOME WATER WILL BE SPILLING OVER THE LEVEES

3) ASSUME RECTANGULAR WIERS AS FOLLOWS

a) WEST BANK $L = 55'$, EAST BANK $L = 170'$, BRIDGE $L = 25$

4) USE WEIR EQUATION $Q = h^{3/2} C L$ WITH $C = 2.65$ FOR A BROAD CRESTED WEIR

5) USE $h = 3.5'$ AS THE ELEVATION OF BLOOMFIELD ROAD IS ABOUT 149' AND THE TOP OF THE LEVEE IS ABOUT EL 15

6) $Q_{BW} = (3.5)^{3/2}(2.65)(55' + 170' + 250') = 8,242$

ESTIMATED CAPACITY OF CHANNEL under existing BLOOMFIELD BRIDGE

1) ASSUME HEAD UPSTREAM 152.5

2) ASSUME RECTANGULAR CULVERT 45' x 12'

3) USING FIGURE 17-29 PAGE 498 CHOW AND $d = 12$, $H/d = 1.29$

$Q/b = 175 \Rightarrow Q = 7,875$

TOTAL FLOW $7875 + 8,242 = 16,117$

Conclude that 152.5 would be appropriate as the control elevation for both th 2% since 16,500cfs $\geq$ 16,117 $<$ 18,800 (1%)

P-1 SANTA CLARA VALLEY WATER DISTRICT, San Jose, California

By Reiller Date 1/14/82 Chkd. By Date Sheet No. 1 of

Subject PAJARO River Control Water Surface elev. Job No.

ABSTRACT:

A Hydraulic Analysis on REACH I & II for Q10% is required to Determine the erosion potential of the Design REACH II CHANNEL, to Determine the Control Point for this Analysis the Hydraulic Properties of the PAJARO / LLAGAS Confluence is needed.

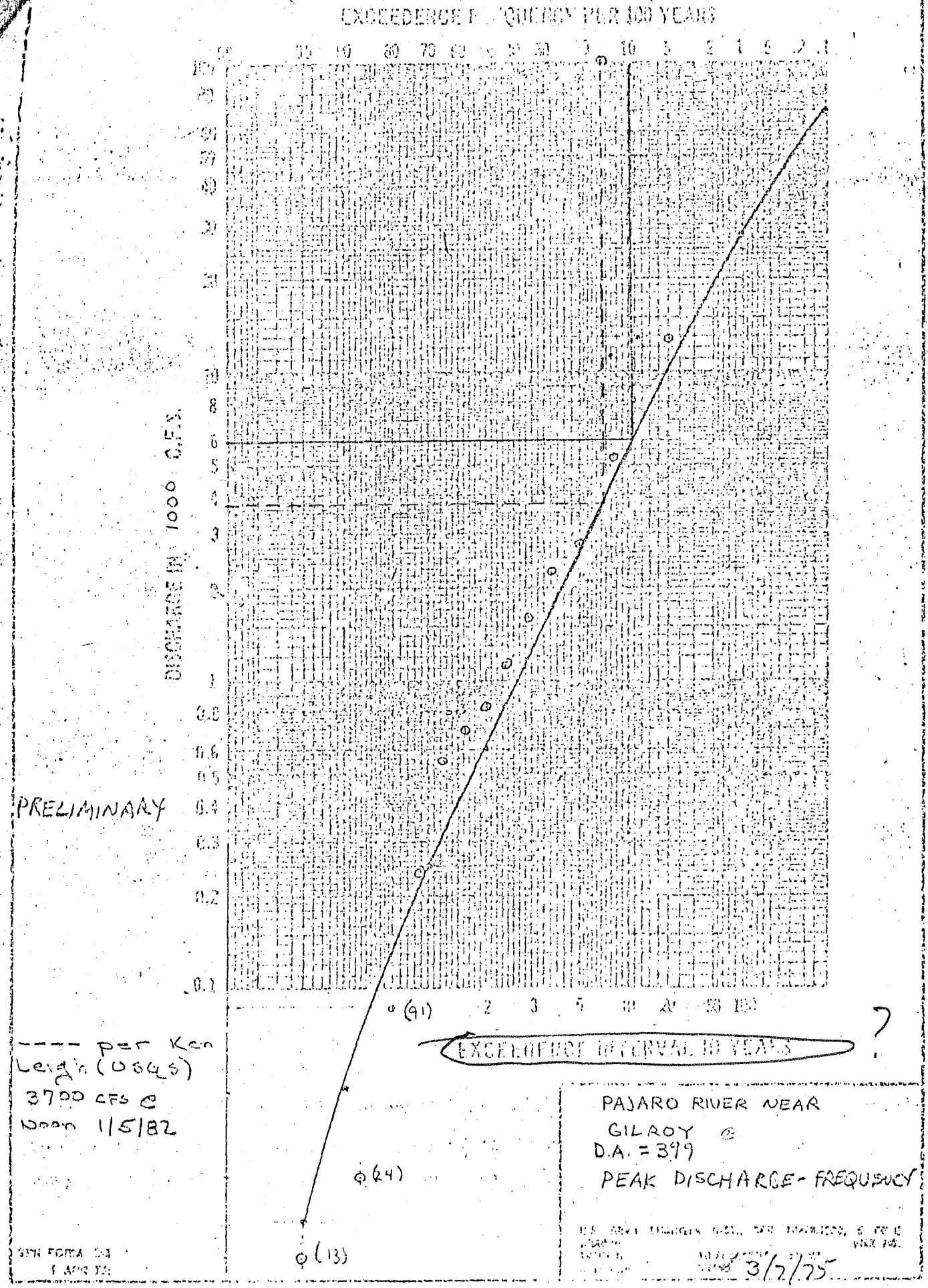
The only Topo available for the Confluence AREA is REACH 1 As builts, U.S.C.G.S., 1989 WAR Dept. MAP, Some 1957 Profiles in Vault & some Rough Cross Sections taken by Kenn Reiller in 1979. (See ATTACHED)

From Normal Depth Analysis of PAJARO D/S of Frazier Lake Road and observations of the January 4 & 5, 1982 Flood @ Frazier Lake RD. & PAJARO as well as Hwy 25 & PAJARO Demonstrated over bank flows as shown in photo graph. It is estimated that During the period that flows overtopped the PAJARO Levees and ponded on either side to elevation 140 ± in the Confluence Vicinity.

As the Jan 4 & 5, 1982 is approximately the 7± year event for the PAJARO the 140 ± msl Water surface elevation is reasonable for a Control beginning Watersurface For the reach II 10% Analysis.

IT is important to note that the 10% SOAP LAKE Watersurface of 136.0 (S.C.S. letter of 12/2/81) is not control here; rather the PAJARO River Floodplain. SOAP LAKE pool is STILL Downstream of Confluence for 10% event.

* Kenn Reiller called Ken Leigh (Coordinating Hydrologist for USGS) who said their stream Gauge @ PAJARO / RT. 25 @ 12 noon 1/5/82 peaked at 8700 cfs which is 5-10 year event. (Recalibration of Gauge in process) the photos the


EXCEEDENCE FREQUENCY PER 100 YEARS
99 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1
DISCHARGE IN 1000 C.F.S.
20
10
8
6
5
4
3
2
1
0.8
0.6
0.5
0.4
0.3
0.2
0.1
φ(91)
φ(24)
φ(13)
EXCEEDENCE INTERVAL IN YEARS
PRELIMINARY
---- per Ken
Leigh (USGS)
3700 CFS @
noon 1/5/82
PAJARO RIVER NEAR
GILROY @
D.A. = 399
PEAK DISCHARGE - FREQUENCY
3/2/75

CHANNEL ROUGHNESS COEFFIENTS

Mannings "N" Value

SELECTION OF MANNINGS n - BASED UPON A SIDE CHANNEL MAINTENANCE PROGRAM ALLOWING ONLY GRASSES ON CHANNEL SIDES BELOW FREEBOARD AND SELECTIVE CLEARING OF LARGE WOODY BRUSH FROM THE CHANNEL BOTTOM

(1) A WEIGHTED VALUE OF MANNINGS n SHALL BE USED FOR CHANNEL CROSS SECTIONS WHOSE PERIMETER IS MADE UP OF SEVERAL TYPES OF MATERIAL OF DIFFERENT ROUGHNESS CHARACTERISTICS.

THE EQUIVALENT COEFFICIENT FOR THE ENTIRE CROSS SECTION WILL VARY WITH DEPTH OF FLOW AND IS EXPRESSED BY THE FOLLOWING EQUATION

$$n = \left[\frac{P_1 n_1^{3/2} + P_2 n_2^{3/2} + P_3 n_3^{3/2}}{P} \right]^{2/3}$$

n = EQUIVALENT ROUGHNESS

n_i = ROUGHNESS COEFFICIENT OF INDIVIDUAL LINING MATERIAL

P_i = WETTED PERIMETER ASSOCIATED WITH ROUGHNESS COEFFICIENT n

P = TOTAL WETTED PERIMETER

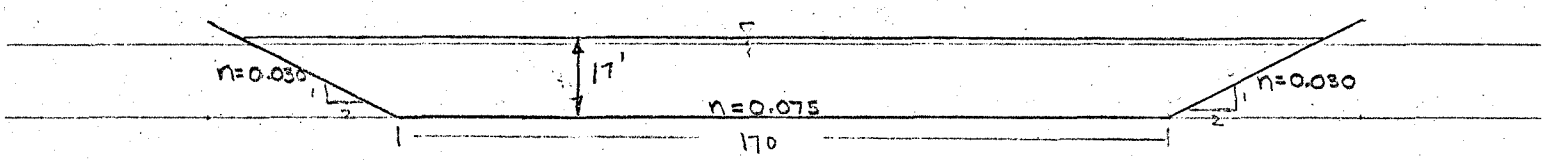
ENGINEERING DESIGN STANDARDS FAR WEST STATES USDA-SCS 1956

SECTION 6-3g

COMPUTATION OF EQUIVALENT ROUGHNESS COEFFICIENT

STATION 22+00 - 54+00

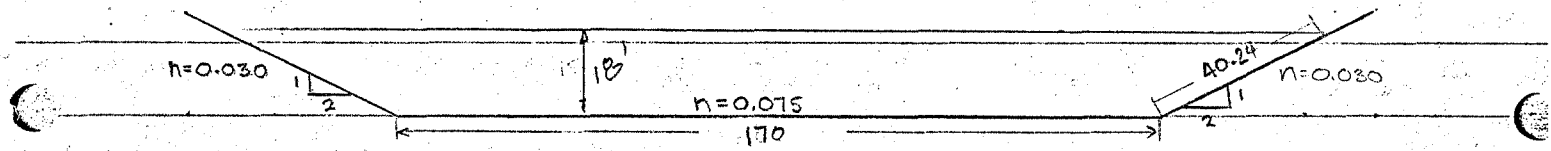
$Q_D = 18{,}800$, $S = 0.001$



$$n = \left[\frac{36.9(0.03)^{3/2} + 170(0.075)^{3/2} + 36.9(0.03)^{3/2}}{246.02}\right]^{2/3} = 0.063$$

STATION 54+00 - 62+00

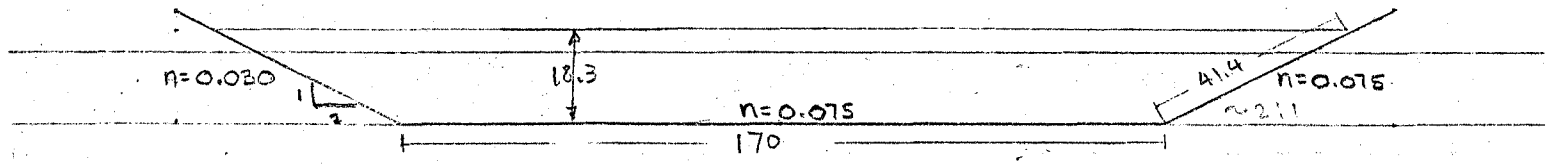
$Q_D = 18{,}300$, $S = 0.001$



$$n = \left[\frac{40.24(0.03)^{3/2} + 170(0.075)^{3/2} + 40.24(0.03)^{3/2}}{250.48}\right]^{2/3} = 0.062$$

STATION 62+00 - 96+00

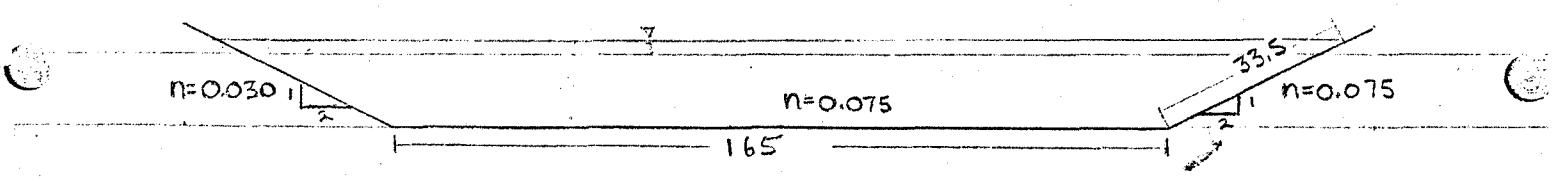
$Q_D = 18{,}300$ $S = 0.001$



$$n = \left[\frac{41.4(0.030)^{3/2} + 170(0.075)^{3/2} + 41.4(0.075)^{3/2}}{252.8}\right]^{2/3} = .069$$

STATION 96+00 - 152+40

$Q_D = 17{,}800$ $S = 0.001$



$$n = \left[\frac{33.5(0.03)^{3/2} + 165(0.075)^{3/2} + 33.5(0.075)^{3/2}}{232}\right]^{2/3} = 0.0695$$

BASED UPON THE PREVIOUSLY DESCRIBED MAINTENANCE PROGRAM A VALUE OF MANNINGS n HAS BEEN COMPUTED FOR BOTH THE CHANNEL BOTTOM AND SIDES. THE PROCEEDURE FOLLOWED IN THE COMPUTATION OF MANNINGS n WAS THAT PRESENTED IN ENGINEERING HANDBOOK, SECTION 5, SUPPLEMENT b, USDA-SCS.

STEP	MODIFYING CONCERN	CHANNEL BOTTOM		CHANNEL SIDES	
		DEGREE	VALUE	DEGREE	VALUE
	BASIC n (CHANNEL IN EARTH)		0.020		0.020
2	SURFACE IRREGULARITY	MINOR	0.005	MINOR	0.005
3	SHAPE AND SIZE OF CROSS SECTION	CHANGES GRADUALLY	0.000	CHANGES GRADUALLY	0.000
4	OBSTRUCTIONS	NEGLIGIBLE	0.000	NEGLIGIBLE	0.000
5	VEGETATION	VERY HIGH	0.050	LOW	0.005
6	MEANDERING OF CHANNEL	MINOR	0.000	MINOR	0.000
7	SUMMATION		0.075		0.030

COMPUTED VALUES OF MANNINGS n AGREE WITH THOSE FOUND IN SUPPLEMENTAL REFERENCE OPEN CHANNEL HYDRAULICS CHOW, P 112

MANNING'S n FOR THE CHANNEL IS GIVEN AS AN EQUIVALENT ROUGHNESS BASED UPON A WEIGHTED AVERAGE. THE EQUIVALENT ROUGHNESS DECREASES WITH DEPTH. A COMPARISON OF THE EQUIVALENT ROUGHNESS CALCULATED AT NORMAL DEPTH FOR FOUR CROSS-SECTIONS REPRESENTING ALL DESIGN CONDITIONS WAS MADE. RESULTS INDICATE THAT A VALUE OF 0.063* WOULD BE CONSERVATIVE FOR ALL DESIGN CALCULATIONS WITH THE EXCEPTION OF THOSE INVOLVING STATIONS 62+00 THROUGH 152+40, INCLUSIVE. A VALUE OF 0.069 WOULD BE REQUIRED FOR STATIONS 62+00 THROUGH 142+00, INCLUSIVE, WHERE ONE BANK WILL BE LEFT IN ITS NATURAL STATE

As specified in; Engr Hndbk, Sec. 5, Supp b, USSCS

Selection of Mannings n - Post Construction

1st step - Selection of Basic n

Character of channel - channel in earth

Basic n - 0.02

2nd step - Selection of modifying value for surface irregularity

- Degree of irregularity - Minor

Surface comparable to good dredged channels; slightly eroded or scoured side slopes of channels

Modifying value 0.005

3rd step - Selection of modifying value for variations in shape and size of cross section

Character of variation in shape and size of cross sections - Changes occur gradually

Modifying value 0.000

4th step - Selection of modifying value for obstructions

Relative effect of obstructions - Negligible

Modifying value 0.000

5TH STEP SELECTION OF MODIFYING VALUE FOR VEGETATION

MUST CONSIDER POSSIBILITY OF STORM OCCURING BEFORE ANY VEGETATION HAS ESTABLISHED

DEGREE OF EFFECT ON n - NEGLIGIBLE

MODIFYING VALUE 0.00

6TH STEP DETERMINATION OF THE MODIFYING VALUE FOR MEANDERING OF CHANNEL

DEGREE OF MEANDERING - MINOR

MODIFYING VALUE 0.00

7TH STEP COMPUTATION OF n FOR THE REACH

$\Sigma n_i = 0.02 + 0.005 = \underline{0.025}$

SELECTION OF MANNINGS n - NATURAL STATE

1ST STEP - SELECTION OF BASIC n

CHARACTER OF CHANNEL - CHANNEL IN EARTH

BASIC n - 0.02

2ND STEP - SELECTION OF MODIFYING VALUE FOR SURFACE IRREGULARITY

DEGREE OF IRREGULARITY - MINOR

SURFACES COMPARABLE TO GOOD DREDGED CHANNELS; SLIGHTLY ERODED OR SCOURED SIDE SLOPES OF CANALS OR DRAINAGE CHANNELS

MODIFYING VALUE 0.005

3RD STED - SECTION OF MODIFYING VALUE FOR VARIATIONS IN SHAPE AND SIZE OF CROSS SECTION

CHARACTER OF VARIATIONS IN SIZE AND SHAPE OF CROSS SECTIONS - CHANGES IN SIZE OR SHAPE OCCURING GRADUALLY

MODIFYING VALUE 0.000

6TH STEP - SELECTION OF MODIFYING VALUE FOR OBSTRUCTIONS

RELATIVE EFFECT OF OBSTRUCTIONS - NEGLIGIBLE

MODIFYING VALUE - 0.000

7TH STEP - SELECTION OF MODIFYING VALUE FOR VEGETATION

VEGETATION AND FLOW CONDITIONS COMPARABLE TO:

GROWING SEASON BUSHY WILLOWS ABOUT 1 YEAR OLD INTERGROWN WITH WEEDS IN FULL FOLIAGE ALONG SIDE SLOPES DENSE GROWTH OF CATTAILS ALONG CHANNEL BOTTOM; ANY VALUE OF HYDRAULIC RADIUS UP TO 10 OR 15 FEET

DEGREE OF EFFECT ON n VERY HIGH

RANGE IN MODIFYING VALUE 0.050 TO 0.100

MODIFYING VALUE 0.050

8TH STEP - DETERMINATION OF THE MODIFYING VALUE FOR MEANDERING OF CHANNEL

DEGREE OF MEANDERING - MINOR

MODIFYING VALUE 0.000

9TH STEP - COMPUTATION OF n FOR THE REACH

$\Sigma n_i = 0.02 + 0.005 + 0.05 = 0.075$

1/27/8
TG

LLAGAS CREEK – REACH 2 Drop Structure

Hydraulic design

The drop structure is designed to contain the hydraulic jump which will occur at a flow rate of 10400cfs in a bare or recently excavated channel. Rarer high flow are expected to occur when the channel was revegetate High tailwaters at the jump due to increased channel resistance prevent supercritical flows from occuring during the rarer high flows. The 10400 cfs ten year flow occuring shortly after construction represents the critical case.

Structure 2 computations show a jump occurs at the 1% flow.

SANTA CLARA VALLEY WATER DISTRICT, San Jose, California

By R-Miller Date _____ Chkd. By _____ Date _____ Sheet No. _____ of _____

Subject BACKWATER ANALYSIS FROM REACH II Job No. _____

DROP STRUCTURE:

Problem:

To Determine Control water surface elevation from Drop structures in Reach II.

Solution

Assume Critical Depth @ crest of Drop Structure:

Find D_c for various Drop structure @ various Q's,

STR.	96+48	132+83	142+83
STRUCT. b'	80	80	100
CREST ELEV.	148.56	157.14	162.78
$Q_{1/10\%}$	10,400	10,400	10,400
D_c 10%	8.06	8.06	6.95
WSE 10%	156.62	165.20	169.73
$Q_{2\%}$	15,400	15,400	15,400
D_c 2%	10.47	10.47	9.02
WSE 2%	159.03	167.61	171.80
$Q_{1\%}$	17800	17800	17,800
D_c 1%	11.53	11.53	9.94
WSE 1%	160.09	168.67	172.72

1/27/8, Ty

LLAGAS CREEK – REACH 2 Drop structure #(1) sta 93+35

Try Saint Anthony Fall type Stilling Basin
Ref: EH SEC 14, chute spillway ES 73 sect. 2.3

Data $Q = 10400$ c/s (10 year flow)
Try crest $b = 80'$

Upstream of the drop the energy is taken as that associated with critical depth. The approximate depth of flow at the toe of the chute is calculated by an energy balance

$$Z + d_c + \frac{V_c^2}{2g} = d_1 + \frac{q^2}{2gd_1^2} \quad \text{—— (1)}$$

d_c^3 at crest $= (10400)^2 / 32.2 / (80)^2$

$$d_c = 8.06$$

$$V = \frac{10400}{(80)(8.06)} = 16.13 \text{ fps}$$

Balance Energy — use (1)

$$5 + 8.06 + \frac{(16.13)^2}{2(32.2)} = d_1 + \frac{(10400/80)^2}{2(32.2)d_1^2}$$

$$d_1 + \frac{262.42}{d_1^2} = 5 + 8.06 + 4.04 = 17.1$$

$$d_1 = 4.6$$

$$V = \frac{10400}{(80)(4.6)} = 28.26 \text{ fps}$$

$$F_1 = \frac{(28.26)^2}{(32.2)(4.6)} = 5.39$$

$$d_2 = \frac{d_1}{2}(-1 + \sqrt{8F_1 + 1} = 12.97$$

Required ht. of T.W $d'_2 = (1.4)(4.6)(5.39)^{0.45} = 13.7$

$$L_B = \frac{(4.5)(12.97)}{(5.39)^{0.32}} = 31'$$

1/27/81

LLAGAS CREEK – REACH 2 Drop structure Hydraulic — TJ
Sta 93+35

Actual tail water depth

$S = .001$

$z = 2$

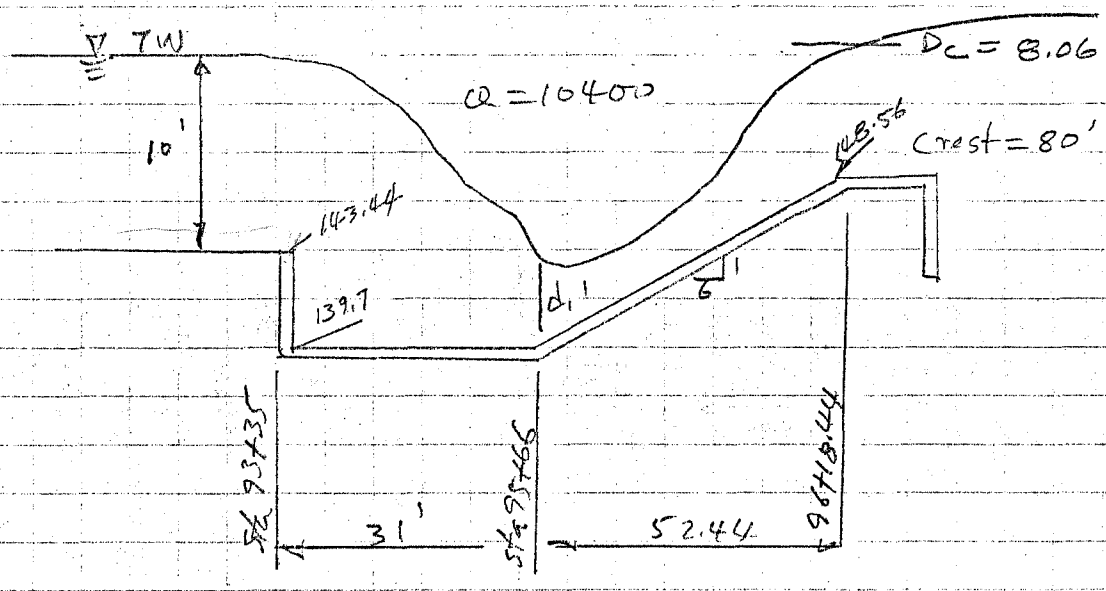
$Q = 10400$

$b = 165$

$n = .035$

$$K' = \frac{Qn}{b^{8/3} S^{1/2}} = \frac{(10400)(.035)}{(818985)(.0316)} = .014$$

$$\frac{D_n}{b} = .06 \qquad D_n = 9.9' \text{ use } 10'$$



Set d_2' at T.W. elevation

∴ stilling basin depth = d_2' − T.W. depth = 13.74 − 10 = 3.74'

Check Q = 17,800 (1% flood) in the stilling basin

locate jump in the stilling basin

At Sta 95+66 From Tail Water

$$A\bar{y} + \frac{QV}{g} = P_1 + M_1$$

$$P_1 + M_1 = (1846.66)\left(\frac{23.08}{2}\right) + \frac{(17800)(9.63)}{32.2} = 26635$$

At sta 96+18.44

$$A\bar{y} + \frac{QV}{g} = P_2 + M_2$$

$$P_2 + M_2 = (923.2)(5.77) + \frac{(17800)(19.28)}{32.2} = 15985$$

At 95+66

$$P_2 + M_2 = (502.4)(3.14) + \frac{(17800)(35.62)}{32.2} = 21158$$

At 95+36

$$P_2 + M_2 = (508.7)(3.18) + \frac{17800\,(34.99)}{32.2} = 20960$$

11/2/10

TJ

LLAGAS CREEK – REACH 2 Drop structure Hydraulic
Sta. 93+35

$P_1 + M_1$ From Tailwater $> P_2 + M_2$

∴ jump will be drowned it in the chute.

STANDARD STEP METHOD

PROJECT

From crest.

	X	I	U	B (Channel bottom)	ZR (Rt Bank)	ZL (Lt Bank)	DEL X (Distance between Sections)	EL (Invert Elevation)	C (Coeff. Losses)	Q (Discharge)	N (Roughness ?)	Y (Depth Normal)	YC (critical depth)	A (Area)	V (Velocity)
4964+18	1	1		80.00	.00	.00	.00	148.56	.00	17800	.0149	11.54	11.54	923.20	19.[illegible]
	95+60			80.00	.00	.00	52.44	139.70	.00	17800	.0149	6.28	11.54	502.40	35.[illegible]
	95+26			80.00	.00	.00	31.00	139.70	.00	17800	.0149	6.35	11.54	508.70	34.9
error															
		1		1.00	.800000000000ex 02		.00		.00	1.00	.143440000000ex 03				.1[illegible]

Dc at Crest

$d^3_{crest} = (17800)^2/32.2/(80)^2$

$d_c = 11.54$

Too much change in $\frac{V^2}{2g}$ should limit to 20%

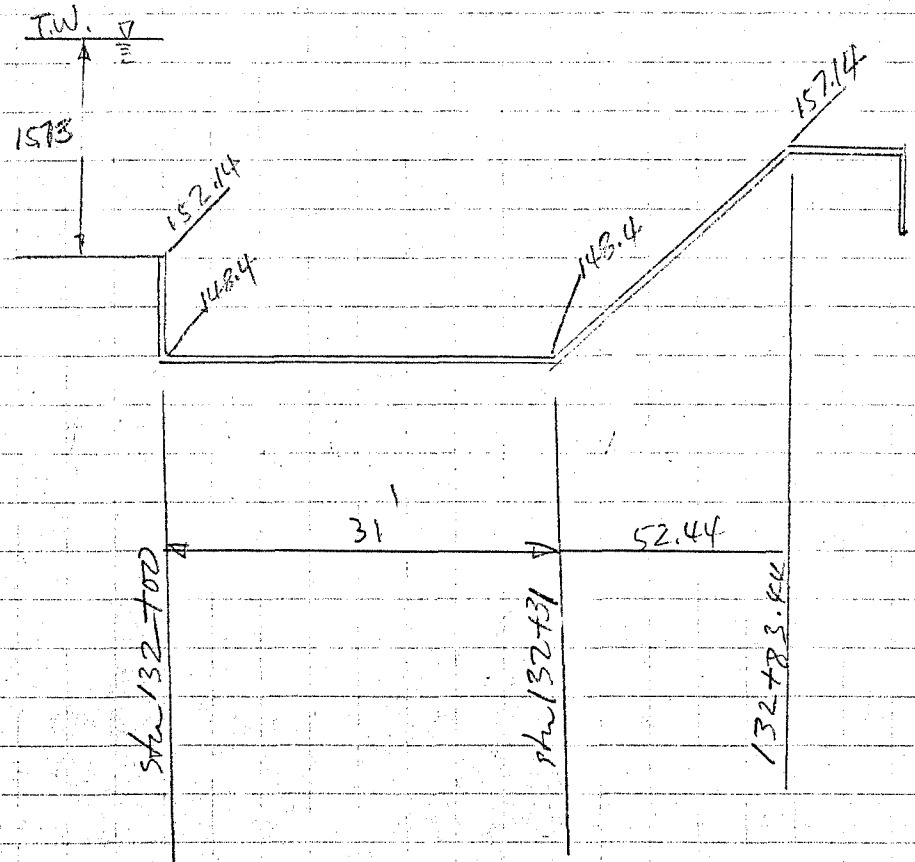
STANDARD STEP METHOD

PROJECT LLAGAS CREEK REACH 2 Drop structure Hydraulic

X	I	U	B	ZR	ZL	DEL X	EL	C	Q	N	Y	YC	A	V
From Tailwater where														
sta 94+35	1	1	165.00	2.00	2.00	.00	143.39	.00	17800	.0349	19.00	6.92	3857.00	4
sta 95+35		1	80.00	.00	.00	100.00	143.44	.10	17800	.0349	17.06	11.54	1365.05	13.
95+361	1	1	80.00	.00	.00	1.00	139.70	.00	17800	.0149	23.08	11.54	1846.66	9
95+66		1	80.00	.00	.00	31.00	139.70	.00	17800	.0149	23.08	11.54	1846.66	9.
error 96+18.44		1	80.00	.00	.00	52.44	148.56	.00	17800	.0149	-.07	11.54	34.27	519

LLAGAS CREEK – REACH 2 – Drop structure #(2) Hydraulic design

Drop structure sta 132+02 #(2),
use the same size structure crest = 80' —— $D_c = 11.5'$ 1%
Flow = 168.68



check jump for the 1% Q = 17800 cfs
Check momentum at sta 132+31

$$A\bar{y} + \frac{QV}{g} = P_1 + M_1$$

$$P_1 + M_1 = (1846.66)\left(\frac{33.03}{2}\right) + \frac{(17800)(9.63)}{32.2}$$

$$= 21310 + 5323 = 26633$$

$$P_2 + M_2 = (504.2)\left(\frac{6.3}{2}\right) + \frac{(17800)(35.30)}{32.2}$$

$$= 1588 + 19514$$

$$= 21102$$

$P_1 + M_1 > P_2 + M_2$ jump will be contain within the basin

where are calc's to show this is true?

By TJ
12/28/81

STANDARD STEP METHOD

PROJECT LAGUNAS CREEK – REACH 2
Drop stru. Stn 132+00

X	I	U	B	ZR	ZL	DEL X	EL	C	Q	N	Y	YC	A	V
1	1	1	165.00	2.00	2.00	.00	152.04	.00	17800	.0349	15.76	6.92	3097.15	5.74
		1	80.00	.00	.00	100.00	152.14	.10	17800	.0349	11.40	11.54	912.08	19.51
1	1	1	1.00	.800000000000ex 02		.00		.00	1.00	.148400000000ex 03				.177
1	1	1	165.00	2.00	2.00	.00	152.04	.00	17800	.0349	15.76	6.92	3097.15	5.74
		1	80.00	.00	.00	100.00	152.14	.10	17800	.0349	11.40	11.54	912.08	19.51
1	1	1	80.00	.00	.00	.00	152.14	.10	17800	.0349	11.40	11.54	912.00	19.51

Void

18,51 ?

Too much change in hr

T.W. D/S to U/S.

?

Stn 131+00	1	1	165.00	2.00	2.00	.00	152.04	.00	17800	.0349	15.76	6.92	3097.15	5.74
Stn 132+00		1	80.00	.00	.00	100.00	152.14	.10	17800	.0349	11.40	11.54	912.08	19.51
Stn 132+01	1	1	80.00	.00	.00	1.00	148.40	.00	17800	.0149	23.08	11.54	1846.66	9.62
Stn 132+31	1		80.00	.00	.00	31.00	148.40	.00	17800	.0149	23.08	11.54	1846.66	9.62

less than Dc

By TJ
12/28/81

STANDARD STEP METHOD

PROJECT LLAGAS CREEK — REACH 2
Drop structure sta 132+00

Too much change in one step

X	I	U	B	ZR	ZL	DEL X	EL	C	Q	N	Y	YC	A	V
1	1		80.00	.00	.00	.00	157.14	.00	17800	.0149	11.54	11.54	923.20	19.28
			80.00	.00	.00	52.44	148.40	.00	17800	.0149	6.30	11.54	504.19	35.30
			80.00	.00	.00	31.00	139.70	.00	17800	.0149	5.18	11.54	414.81	42.91

error
1

this is elev of first drop

Computing
Up St. ____
Dn. St. ____

STANDARD STEP METHOD

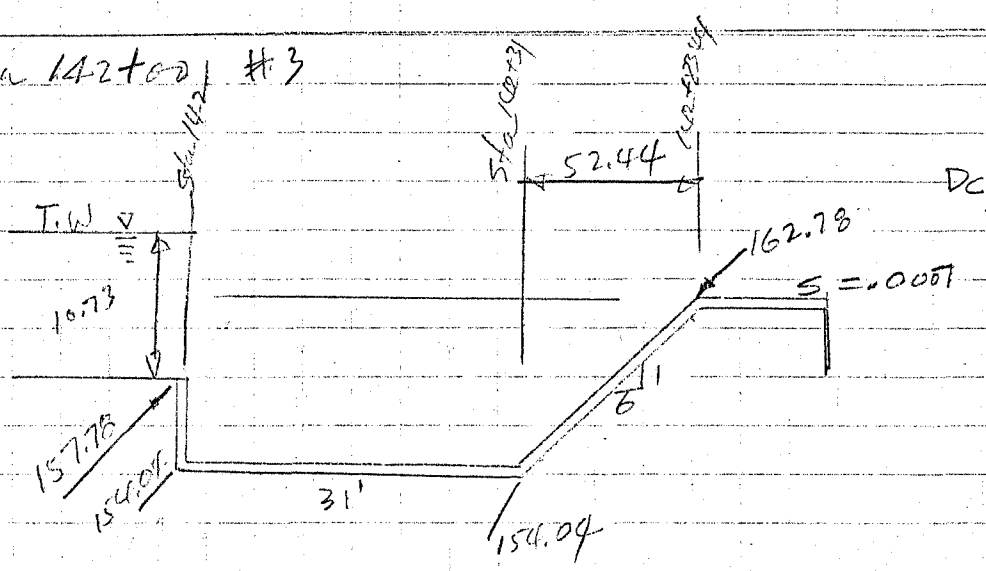
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Project _____ Name _____ Date _____

(1) X	(2) I	(3) b	(4) Z_R	(5) Z_L	(6) ΔX	(7) EI	(8) C	(9) Q	(10) n	(11) y	(12) $\frac{A^3}{T} - \frac{Q^2}{g}$	(13)
1	1	165	2	2	0	152.04	0	17800	.035	15.76		
0	0	80	0	0	100	152.14	0.1					
1	1	80	0	0	1	148.4	0	17800	.015			
0	0	80	0	0	31	148.4	0					
1	1	80	0	0	0	157.14	0	17800	.015	11.54		
0	0	80	0	0	52.44	148.4	0					
0	0	80	0	0	31	139.7	0					
1	1	80	0	0	1	152.14	0	17800	.035			

LLAGAS CREEK – REACH 2 – Drop structure #3 Hydraulic de

Sta 142+00 | #3



Ten percent $Q = 10400$ c/s

$S = .0007$

$z = 2$

$Q = 10400$

$b = 165$

$n = .035$

$$K = \frac{(10400)(.035)}{(818985)(.0265)} = .0168$$

$$\frac{D_n}{b} = .065 \qquad D_n = 10.73$$

∴ use the same size as structure 2

1% W.S. at the confluence = 180.58 > Elev 178. N
Try to limit the T.W. Ele at 178

∴ Try crest width 100'

$D_c = 9.95$ control W.S Elev = 162.78 + 9.95
= 172.73

THE DROP STRUCTURE IS COMPOSED OF A CHUTE HAVING A 6 TO 1 SLOPE AND A SAINT ANTHONY FALLS TYPE STILLING BASIN. (E.M. SEC 14, CHUTE SPILLWAYS). A DENIL FISHWAY IS INCLUDED IN THE STRUCTURE WHICH LIMITS THE CHUTE SLOPE TO 6 TO 1.

THE STILLING BASIN IS DESIGNED TO DISSIPATE THE ENERGY ASSOCIATED WITH A FIVE FOOT CHANNEL FALL IN A NON EROSIVE MANNER. THE DESIGN FLOW IS 10400 cfs, THE 10% FLOW. THIS FLOW IS CRITICAL JUST AFTER EXCAVATION WHEN THE CHANNEL OFFERS LEAST RESISTANCE TO FLOW. THE DROP STRUCTURE WILL SAFELY PASS FLOW OF LESSER FREQUENCY WHEN THE CHANNEL VEGETATION IS REESTABLISHED

N *IS *) LE SS- TI NI I AT ME GE SUM Y RR L

NOTE: THIS Summary printout provides Q10% From STA. 22400 (i.e. where Levee overbanking occurs) to STA. 95400

T1 REACH I AND REACH 2 TO STA. 9500 (I.E. DROP STRUCTURE)
T2 1% FLOW OF 18600 CFS , "N" = 0.063
T3 ASSUME WEIR FLOW OVER LEVEE AT STA. 22+00 AT W.S.E. = 152.5

SECNO	Q	VCH	DEPTH	F*XNCH	CWSEL	ELMIN	XLBEL	RBEL
22.000	18800.00	6.07	16.35	63.00	152.50	136.15	151.55	151.85
23.000	18800.00	6.17	16.45	63.00	152.70	136.25	154.25	154.25
24.000	18800.00	5.50	16.67	63.00	153.02	136.35	156.75	156.75
26.000	18800.00	5.45	16.80	63.00	153.35	136.55	156.95	156.95
28.000	18800.00	5.40	16.92	63.00	153.67	136.75	157.15	157.15
30.000	18800.00	5.36	17.04	63.00	153.99	136.95	157.35	157.35
32.000	18800.00	5.32	17.15	63.00	154.30	137.15	157.55	157.55
34.000	18800.00	5.28	17.25	63.00	154.60	137.35	157.75	157.75
36.000	18800.00	5.25	17.34	63.00	154.89	137.55	157.95	157.95
38.000	18800.00	5.21	17.43	63.00	155.18	137.75	158.15	158.15
40.000	18800.00	5.19	17.51	63.00	155.46	137.95	158.35	158.35
42.000	18800.00	5.16	17.59	63.00	155.74	138.15	158.55	158.55
44.000	18800.00	5.13	17.67	63.00	156.02	138.35	158.75	158.75
46.000	18800.00	5.11	17.74	63.00	156.29	138.55	158.95	158.95
48.000	18800.00	5.09	17.80	63.00	156.55	138.75	159.15	159.15
50.000	18800.00	5.07	17.87	63.00	156.82	138.95	159.35	159.35
52.000	18800.00	5.05	17.93	63.00	157.08	139.15	159.55	159.55
54.000	17800.00	4.80	18.01	63.00	157.36	139.35	162.55	162.55
56.000	17800.00	4.79	18.04	63.00	157.59	139.55	162.75	162.75
58.000	17800.00	4.78	18.06	63.00	157.81	139.75	162.95	162.95

58.	1	80.	.7	06	6	0	57	9.	.99	1	.95

SECNO	Q	VCH	DEPTH	K*XNCH	CWSEL	ELMIN	XLBEL	RBEL
60.000	17800.00	4.77	18.09	63.00	158.04 158.39	139.95	163.15	163.15
62.000	17800.00	4.76	18.11	63.00	158.26	140.15	163.35	163.35
63.000	17800.00	4.97	18.11	63.00	158.36 158.74	140.25	164.15	140.25
65.000	17800.00	4.96	18.13	63.00	158.58	140.45	164.35	140.45
67.000	17800.00	4.96	18.15	63.00	158.80	140.65	164.55	140.65
69.000	17800.00	4.96	18.16	63.00	159.01 159.39	140.85	164.75	140.85
71.000	17800.00	4.95	18.18	63.00	159.23 159.61	141.05	164.95	141.05
73.000	17800.00	4.95	18.19	63.00	159.44	141.25	165.15	141.25
75.000	17800.00	4.94	18.21	63.00	159.66 160.04	141.45	165.35	141.45
77.000	17800.00	4.94	18.22	63.00	159.87 160.25	141.65	165.55	141.65
79.000	17800.00	4.93	18.23	63.00	160.08	141.85	165.75	141.85
81.000	17800.00	4.93	18.24	63.00	160.29 160.67	142.05	165.95	142.05
82.000	17800.00	4.72	18.27	63.00	160.42 160.77	142.15	165.35	165.35
84.000	17800.00	4.71	18.29	63.00	160.64	142.35	165.55	165.55
86.000	17800.00	4.71	18.30	63.00	160.85	142.55	165.75	165.75
88.000	16300.00	4.83	18.31	63.00	161.06 161.42	142.75	165.95	165.95
88.720	18300.00	4.83	18.32	63.00	161.14	142.82	166.02	166.02
88.870	18300.00	4.83	18.32	63.00	161.16	142.84	166.04	166.04
90.000	18300.00	4.83	18.34	63.00	161.29 161.65	142.95	166.15	166.15
91.00	18300.00	4.	18.34	63.00	161.39	143.05	166.25	166.25

91	0	500	4.[illegible]	.3[illegible]	00	16[illegible]		43.	6.4	.45
92.000	18300.00	4.96	18.36	63.00	161.51		143.15	166.55	166.55
94.000	17800.00	4.81	18.42	63.00	161.77	162.13	143.35	166.75	166.75
95.000	17800.00	4.80	18.43	63.00	161.88	162.24	143.45	166.85	166.85

* Between sta 96.184 and sta 151+82 see sht 16

UMMARY OF ERRORS

ORG R 11, 03
MODIFICATION = 50,51,52
****

N e: ... @ 2% From STA. 22+00 (i.e. Approximately where Levee overbanking occurs) to STA 95+00

TE= ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

T1 LLAGAS CREEK , REACH 2 , STA. 22+00 TO STA. 95+00
T2 2% FLOW OF 16500 CFS , "N" = 0.063
T3 ASSUME WEIR FLOW OVER LEVEE AT STA. 22+00 AT W.S.E. = 152.5

SECNO	Q	VCH	DEPTH	K*XNCH	C-SEL	ELMIN	XLREL	RSEL
22.000	16500.00	5.33	16.35	63.00	152.50	136.15	151.55	151.85
23.000	16500.00	5.43	16.40	63.00	152.65	136.25	154.25	154.25
24.000	16500.00	4.87	16.55	63.00	152.90	136.35	156.75	156.75
26.000	16500.00	4.84	16.61	63.00	153.16	136.55	156.95	156.95
28.000	16500.00	4.82	16.66	63.00	153.41	136.75	157.15	157.15
30.000	16500.00	4.81	16.72	63.00	153.67	136.95	157.35	157.35
32.000	16500.00	4.79	16.77	63.00	153.92	137.15	157.55	157.55
34.000	16500.00	4.77	16.82	63.00	154.17	137.35	157.75	157.75
36.000	16500.00	4.76	16.87	63.00	154.42	137.55	157.95	157.95
38.000	16500.00	4.74	16.91	63.00	154.66	137.75	158.15	158.15
40.000	16500.00	4.73	16.95	63.00	154.90	137.95	158.35	158.35
42.000	16500.00	4.72	16.99	63.00	155.14	138.15	158.55	158.55
44.000	16500.00	4.70	17.03	63.00	155.38	138.35	158.75	158.75
46.000	16500.00	4.69	17.06	63.00	155.61	138.55	158.95	158.95
48.000	16500.00	4.68	17.10	63.00	155.85	138.75	159.15	159.15
50.000	16500.00	4.67	17.13	63.00	156.08	138.95	159.35	159.35
52.000	16500.00	4.66	17.16	63.00	156.31	139.15	159.55	159.55

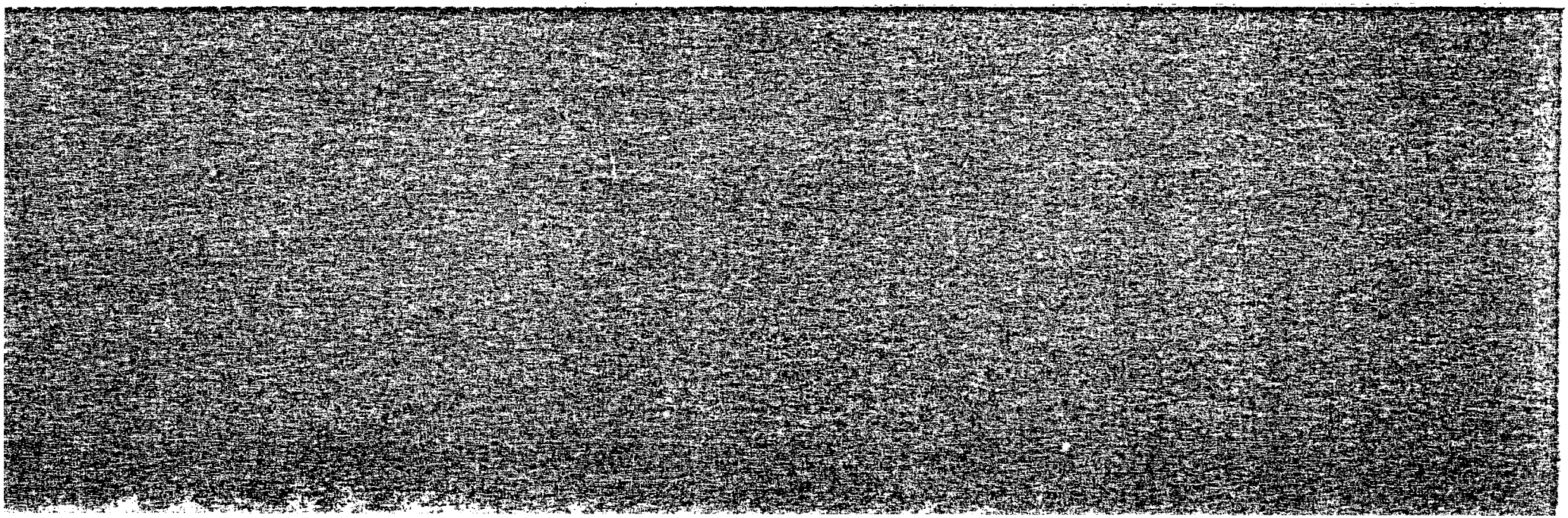
50.000	16500.00	4.67	17.13	63.00	156.08	138.95	159.35	159.35
52.000	16500.00	4.66	17.16	63.00	156.31	139.15	159.55	159.55
54.000	15900.00	4.52	17.20	63.00	156.55	139.35	162.55	162.55
56.000	15900.00	4.52	17.22	63.00	156.77	139.55	162.75	162.75
58.000	15900.00	4.51	17.23	63.00	156.98	139.75	162.95	162.95

SECNO	Q	VCH	DEPTH	K*XNCH	CRSEL	ELMIN	XLBEL	RBEL
60.000	15900.00	4.51	17.24	63.00	157.19	139.95	163.15	163.15
62.000	15900.00	4.51	17.25	63.00	157.40	140.15	163.35	163.35
63.000	15900.00	4.69	17.25	63.00	157.50	140.25	164.15	140.25
65.000	15900.00	4.69	17.25	63.00	157.70	140.45	164.35	140.45
67.000	15900.00	4.69	17.26	63.00	157.91	140.65	164.55	140.65
69.000	15900.00	4.69	17.26	63.00	158.11	140.85	164.75	140.85
71.000	15900.00	4.69	17.27	63.00	158.32	141.05	164.95	141.05
73.000	15900.00	4.69	17.27	63.00	158.52	141.25	165.15	141.25
75.000	15900.00	4.69	17.27	63.00	158.72	141.45	165.35	141.45
77.000	15900.00	4.69	17.28	63.00	158.93	141.65	165.55	141.65
79.000	15900.00	4.68	17.28	63.00	159.13	141.85	165.75	141.85
81.000	15900.00	4.68	17.29	63.00	159.34	142.05	165.95	142.05
82.000	15900.00	4.49	17.31	63.00	159.46	142.15	165.35	165.35
84.000	15900.00	4.49	17.32	63.00	159.67	142.35	165.55	165.55
86.000	15900.00	4.48	17.33	63.00	159.88	142.55	165.75	165.75

88,720	15400,00	4,34	17,35	63,00	160,17	142,82	166,02	166,02
88,870	15400,00	4,34	17,34	63,00	160,18	142,84	166,04	166,04
90,000	15400,00	4,34	17,34	63,00	160,29	142,95	166,15	166,15
91,000	15400,00	4,47	17,33	63,00	160,38	143,05	166,45	166,45
92,000	15400,00	4,47	17,33	63,00	160,48	143,15	166,55	166,55
94,000	17800,00	5,17	17,30	63,00	160,65	143,35	166,75	166,75
95,000	17800,00	5,18	17,34	63,00	160,79	143,45	166,85	166,85

Between sta 96+184 and sta 151+82 see sht 16

SUMMARY OF ERRORS



NOTE: THIS SUMMARY PRINTOUT PROVIDES REACH I WITH MANNING'S "N" @ 0.063 AND REACH II WITH MANNING'S "N" @ 0.026 FOR EXCAVATED REACHS AND 0.075 FOR REACHES WITH NATURAL CHANNEL BANKS RETAINED FOR THE 10% EVENT.

THIS RUN EXECUT

C

T1 MAIN BRANCH LLAGAS CREEK) DETERMINE HYDRAULICS FOR REACH NO.2 FOR 10% EVENT
T2 CONSIDER 10% FLOOD OF 10400CFS WITH "N" = 0.025 SOAP LAKE AT W.S.E. = 140MSL
T3 REACH 1 TOPO FROM 1972 AS BUILTS;X-SECT. LOOKING UPSTREAM

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

1 TOPO FROM 1972 AS BUI

SUMMARY PRINTOUT

SECNO	Q	VCH	DEPTH	K*XNCH	CWSEL	ELMIN	XLBEL	RBEL
300.000	11000.00	6.31	11.50	63.00	140.00	128.50	146.00	146.00
400.000	11000.00	6.03	11.87	63.00	140.47	128.60	146.10	146.10
500.000	11000.00	5.81	12.19	63.00	140.89	128.70	146.20	146.20
600.000	11000.00	5.64	12.45	63.00	141.25	128.80	146.30	146.30
700.000	11000.00	5.50	12.68	63.00	141.58	128.90	146.40	146.40
750.000	11000.00	5.44	12.78	63.00	141.73	128.95	146.45	146.45
895.000	11000.00	5.41	11.15	63.00	142.15	131.00	146.00	146.00
995.000	11000.00	5.30	11.34	63.00	142.44	131.10	146.10	146.10
1095.000	11000.00	5.20	11.52	63.00	142.72	131.20	146.20	146.20
1200.000	11000.00	5.06	11.79	63.00	142.99	131.20	146.20	146.20
1300.000	11000.00	4.98	11.92	63.00	143.23	131.31	146.31	146.31
1400.000	11000.00	4.92	12.05	63.00	143.45	131.41	146.41	146.41

50 0	00	5,4	,78	6 0	141	18,	,4'	1 45
895,000	11000,00	5,41	11,15	63,00	142,15	131,00	146,00	146,00
995,000	11000,00	5,30	11,34	63,00	142,44	131,10	146,10	146,10
1095,000	11000,00	5,20	11,52	63,00	142,72	131,20	146,20	146,20
1200,000	11000,00	5,06	11,79	63,00	142,99	131,20	146,20	146,20
1300,000	11000,00	4,98	11,92	63,00	143,23	131,31	146,31	146,31
1400,000	11000,00	4,92	12,05	63,00	143,45	131,41	146,41	146,41
2500,000	11000,00	4,49	12,94	63,00	145,54	132,60	146,80	146,80
2800,000	11000,00	4,42	13,22	63,00	146,02	132,80	148,72	148,72
3000,000	11000,00	4,39	13,31	63,00	146,31	133,00	150,00	150,00
4200,000	11000,00	4,21	13,77	63,00	147,97	134,20	150,30	150,30
4693,000	11000,00	4,16	13,91	63,00	148,60	134,69	151,30	151,30
4888,000	11000,00	4,15	13,96	63,00	148,85	134,89	151,50	151,50
4912,000	11000,00	4,18	13,86	63,00	148,85	134,99	151,60	151,60
5124,000	11000,00	4,93	15,98	63,00	149,10	133,12	152,00	152,00

SECNO	Q	VCH	DEPTH	K*XNCH	CWSEL	ELMIN	XLBEL	RBEL
6120,000	11000,00	4,45	16,57	63,00	150,69	134,12	153,00	153,00
22,000	11000,00	4,07	14,60	25,00	150,75	136,15	151,55	151,85
23,000	11000,00	4,18	14,51	25,00	150,76	136,25	154,25	154,25
24,000	11000,00	3,79	14,48	25,00	150,83	136,35	156,75	156,75
26,000	11000,00	3,84	14,31	25,00	150,86	136,55	156,95	156,95
28,000	11000,00	3,89	14,13	25,00	150,88	136,75	157,15	157,15

4912,000	11000,00	4,18	13,86	63,00	148,85	134,99	151,60	151,60
5124,000	11000,00	4,93	15,98	63,00	149,10	133,12	152,00	152,00

SECNO	Q	VCH	DEPTH	K*XNCH	CWSEL	ELMIN	XLBEL	RBEL
6120,000	11000,00	4,45	16,57	63,00	150,69	134,12	153,00	153,00
22,000	11000,00	4,07	14,60	25,00	150,75	136,15	151,55	151,85
23,000	11000,00	4,18	14,51	25,00	150,76	136,25	154,25	154,25
24,000	11000,00	3,79	14,48	25,00	150,83	136,35	156,75	156,75
26,000	11000,00	3,84	14,31	25,00	150,86	136,55	156,95	156,95
28,000	11000,00	3,89	14,13	25,00	150,88	136,75	157,15	157,15
30,000	11000,00	3,95	13,96	25,00	150,91	136,95	157,35	157,35
32,000	11000,00	4,01	13,79	25,00	150,94	137,15	157,55	157,55
34,000	11000,00	4,06	13,62	25,00	150,97	137,35	157,75	157,75
36,000	11000,00	4,12	13,45	25,00	151,00	137,55	157,95	157,95
38,000	11000,00	4,18	13,28	25,00	151,03	137,75	158,15	158,15
40,000	11000,00	4,24	13,12	25,00	151,07	137,95	158,35	158,35
42,000	11000,00	4,30	12,95	25,00	151,10	138,15	158,55	158,55
44,000	11000,00	4,36	12,79	25,00	151,14	138,35	158,75	158,75
46,000	11000,00	4,43	12,63	25,00	151,18	138,55	158,95	158,95
48,000	11000,00	4,49	12,47	25,00	151,22	138,75	159,15	159,15
50,000	11000,00	4,56	12,31	25,00	151,26	138,95	159,35	159,35
52,000	11000,00	4,62	12,16	25,00	151,31	139,15	159,55	159,55

.00	110 .00	.6	12	25.	.2	1 95	15 5	59
52.000	11000.00	4.62	12.16	25.00	151.31	139.15	159.55	159.55
54.000	10700.00	4.59	12.01	25.00	151.36	139.35	162.55	162.55
56.000	10700.00	4.65	11.86	25.00	151.41	139.55	162.75	162.75
58.000	10700.00	4.72	11.71	25.00	151.46	139.75	162.95	162.95
60.000	10700.00	4.79	11.56	25.00	151.51 153.59	139.95	163.15	163.15
62.000	10700.00	4.86	11.42	25.00	151.57	140.15	163.35	163.35
63.000	10700.00	5.15	11.32	25.00	151.57 153.56	140.25	164.15	140.25
65.000	10700.00	5.21	11.18	25.00	151.63	140.45	164.35	140.45
67.000	10700.00	5.28	11.04	25.00	151.69	140.65	164.55	140.65
69.000	10700.00	5.36	10.90	25.00	151.75 152.20	140.85	164.75	140.85
71.000	10700.00	5.43	10.77	25.00	151.82 152.28	141.05	164.95	141.05
73.000	10700.00	5.50	10.64	25.00	151.89 CWSEL	141.25	165.15	141.25

SECNO	Q	VCH	DEPTH	K*XNCH	CWSEL	ELMIN	XLBEL	RBEL
75.000	10700.00	5.57	10.51	25.00	151.96	141.45 141.93	165.35	141.45
77.000	10700.00	5.64	10.39	25.00	152.04	141.65 142.14	165.55	141.65
79.000	10700.00	5.71	10.27	25.00	152.12	141.85	165.75	141.85
81.000	10700.00	5.78	10.15	25.00	152.20 152.72	142.05	165.95	142.05
82.000	10700.00	5.55	10.14	25.00	152.29 152.77	142.15	165.35	165.35
84.000	10700.00	5.61	10.03	25.00	152.38	142.35	165.55	165.55
86.000	10700.00	5.68	9.92	25.00	152.47	142.55	165.75	165.75
88.000	10400.00	5.57	9.84	25.00	152.59	142.75	165.95	165.95

8[illegible]	0	'00	5,[illegible]	,14	00	15[illegible]	42.[illegible]	5,3[illegible]	[illegible],35
84,000	10700,00	5,61	10,03	25,00	152,38	142,35	165,55	165,55
86,000	10700,00	5,68	9,92	25,00	152,47	142,55	165,75	165,75
88,000	10400,00	5,57✓	9,84	25,00	152,59 153,07	142,75	165,95	165,95
88,720	10400,00	5,60	9,80	25,00	152,62	142,82	166,02	166,02
88,870	10400,00	5,59	9,81	25,00	152,65	142,84	166,04	166,04
90,000	10400,00	5,62✓	9,75	25,00	152,70 153,19	142,95	166,15	166,15
91,000	10400,00	5,84	9,68	25,00	152,73	143,05	166,45	166,45
92,000	10400,00	5,87	9,63	25,00	152,78	143,15	166,55	166,55
94,000	10400,00	5,93	9,54	25,00	152,89 153,49	143,35	166,75	166,75
95,000	10400,00	5,97	9,49	25,00	152,94 153,49	143,45	166,85	166,85

MMARY OF ERRORS

sht11

SE	Q	CH	TH	K*	CWS	CRI	VEL	R
96.184	10400.00	16.13	8.06	25.00	156.62	148.56	166.49	166.49
97.000	10400.00	4.87	12.08	25.00	160.72	148.64	148.64	166.00
98.000	10400.00	4.90	12.00	25.00	160.74	148.74	148.74	166.10
100.000	10400.00	4.96	11.85	25.00	160.79	148.94	148.94	166.30
102.000	10400.00	5.03	11.70	25.00	160.84	149.14	149.14	166.50
104.000	10400.00	5.10	11.56	25.00	160.90	149.34	149.34	166.70
106.000	10400.00	5.17	11.41	25.00	160.95	149.54	149.54	166.90
108.000	10400.00	5.23	11.27	25.00	161.01	149.74	149.74	167.10
110.000	10400.00	5.30	11.13	25.00	161.07	149.94	149.94	167.30
110.550	10400.00	5.33	11.09	25.00	161.09	150.00	150.00	167.36
111.850	10400.00	5.37	11.01	25.00	161.13	150.12	150.12	167.48
113.000	10400.00	5.41	10.93	25.00	161.17	150.24	150.24	167.60
115.000	10400.00	5.48	10.80	25.00	161.24	150.44	150.44	167.80
117.000	10400.00	5.55	10.67	25.00	161.31	150.64	150.64	168.00
119.000	10400.00	5.62	10.55	25.00	161.39	150.84	150.84	168.20
121.000	10400.00	5.69	10.43	25.00	161.47	151.04	151.04	168.40
123.000	10400.00	5.76	10.31	25.00	161.55	151.24	151.24	168.60
125.000	10400.00	5.83	10.19	25.00	161.63	151.44	151.44	168.80
127.000	10400.00	5.89	10.08	25.00	161.72	151.64	151.64	169.00
129.000	10400.00	5.96	9.97	25.00	161.81	151.84	151.84	169.20

12 00 40( ) 5.^ .9" .00 16' . .51 .^ ' .20

SECNO	Q	VCH	DEPTH	K*XNCH	CWSEL	ELMIN	XLBEL	RBEL
130.000	10400.00	6.00	9.92	25.00	161.86	151.94	151.94	169.30
131.000	10400.00	6.03	9.87	25.00	161.91	152.04	152.04	169.40
132.000	10400.00	6.06	9.81	25.00	161.95	152.14	152.14	169.50

UMMARY OF ERRORS

sht 13

IFT .IO= 5 .1,5
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NOTE= ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

STRUCTURE ANALSIS DONE

SUMMARY PRINTOUT

SECNO	Q	VCH	DEPTH	K*XNCH	CWSEL	ELMIN	XLBEL	RBEL
132.830	10400.00	16.13	8.06	25.00	165.20	157.14	172.00	172.00
134.000	10400.00	4.31	12.18	25.00	169.40	157.22	172.00	172.00
135.000	10400.00	4.33	12.13	25.00	169.42	157.29	172.07	172.07
137.000	10400.00	4.37	12.04	25.00	169.47	157.43	172.21	172.21
138.000	10400.00	4.39	11.99	25.00	169.49	157.50	172.28	172.28
138.970	10400.00	4.41	11.94	25.00	169.51	157.57	172.35	172.35
139.550	10400.00	4.42	11.92	25.00	169.53	157.61	172.39	172.39
140.000	10400.00	4.43	11.90	25.00	169.54	157.64	172.42	172.42
142.000	10400.00	4.47	11.81	25.00	169.59	157.78	172.56	172.56

SUMMARY OF ERRORS

sht14

MC IC UN 50 ,52

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NOTE= ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

STRUCTURE ANALSIS DONE

SUMMARY PRINTOUT

SECNO	Q	VCH	DEPTH	K*XNCH	CWSEL	ELMIN	XLBEL	RBEL
142.830	10400.00	14.96	6.95	25.00	169.73	162.78	183.00	183.00
144.350	10400.00	5.39	10.34	25.00	173.22	162.88	182.00	185.00
145.540	10400.00	5.41	10.31	25.00	173.27	162.96	182.08	185.08
146.540	10400.00	5.42	10.28	25.00	173.31	163.03	182.15	185.15
147.150	10400.00	5.43	10.27	25.00	173.34	163.07	182.19	185.19
147.720	10400.00	5.21	10.31	35.00	173.42	163.11	185.50	187.00
148.550	10400.00	5.31	10.31	35.00	173.48	163.17	184.50	187.00
149.470	10400.00	4.80	10.40	35.00	173.63	163.23	184.00	187.00
150.570	10400.00	4.52	10.44	35.00	173.75	163.31	185.00	187.50
151.820	10400.00	4.27	10.45	35.00	173.85	163.40	184.00	288.00

SUMMARY OF ERRORS

& 2%
Q 1%

	SECNO	Q	VCH	DEPTH	K*XNCH	CWSEL	ELMIN	XLBEL	RBEL
	96.184	10400.00	16.13	8.06	63.00	156.62	148.56	166.49	166.49
2%	96.184	15400.00	18.39	10.47	63.00	159.03	148.56	166.49	166.49
1%	96.184	17800.00	19.30	11.53	63.00	160.09	148.56	166.49	166.49
	97.000	10400.00	4.70	12.40	63.00	161.04	148.64	148.64	166.00
	97.000	15400.00	5.26	16.02	63.00	164.66	148.64	148.64	166.00
	97.000	17800.00	5.48	17.62	63.00	166.26	148.64	148.64	166.00
	98.000	10400.00	4.67	12.46	63.00	161.20	148.74	148.74	166.10
	98.000	15400.00	5.25	16.06	63.00	164.80	148.74	148.74	166.10
	98.000	17800.00	5.46	17.66	63.00	166.40	148.74	148.74	166.10
	100.000	10400.00	4.63	12.56	63.00	161.50	148.94	148.94	166.30
	100.000	15400.00	5.22	16.14	63.00	165.08	148.94	148.94	166.30
	100.000	17800.00	5.44	17.73	63.00	166.67	148.94	148.94	166.30
	102.000	10400.00	4.59	12.66	63.00	161.80	149.14	149.14	166.50
	102.000	15400.00	5.19	16.22	63.00	165.36	149.14	149.14	166.50
	102.000	17800.00	5.42	17.80	63.00	166.94	149.14	149.14	166.50
	104.000	10400.00	4.56	12.74	63.00	162.08 162.40	149.34	149.34	166.70
	104.000	15400.00	5.17	16.29	63.00	165.63	149.34	149.34	166.70
	104.000	17800.00	5.40	17.86	63.00	167.20 167.65	149.34	149.34	166.70
	106.000	10400.00	4.53	12.82	63.00	162.36 162.67	149.54	149.54	166.90
	106.000	15400.00	5.14	16.36	63.00	165.90	149.54	149.54	166.90
	106.000	17800.00	5.38	17.92	63.00	167.46 167.78	149.54	149.54	166.90
	108.000	10400.00	4.50	12.90	63.00	162.64	149.74	149.74	167.10
	108.000	15400.00	5.12	16.43	63.00	166.17	149.74	149.74	167.10
	108.000	17800.00	5.36	17.98	63.00	167.72	149.74	149.74	167.10
	110.000	10400.00	4.47	12.97	63.00	162.91	149.94	149.94	167.30
	110.000	15400.00	5.10	16.49	63.00	166.43	149.94	149.94	167.30
	110.000	17800.00	5.34	18.03	63.00	167.97	149.94	149.94	167.30
	110.550	10400.00	4.47	12.98	63.00	162.98	150.00	150.00	167.36
	110.550	15400.00	5.10	16.50	63.00	166.50	150.00	150.00	167.36
	110.550	17800.00	5.34	18.04	63.00	168.04	150.00	150.00	167.36

SECNO	Q	VCH	DEPTH	K*XNCH	CWSEL		ELMIN	XLBEL	RBEL
111.850	10400.00	4.45	13.04	63.00	163.16		150.12	150.12	167.48
111.850	15400.00	5.08	16.54	63.00	166.66		150.12	150.12	167.48
111.850	17800.00	5.32	18.09	63.00	168.21		150.12	150.12	167.48
113.000	10400.00	4.44	13.07	63.00	163.31		150.24	150.24	167.60
113.000	15400.00	5.07	16.57	63.00	166.81		150.24	150.24	167.60
113.000	17800.00	5.32	18.11	63.00	168.35		150.24	150.24	167.60
115.000	10400.00	4.42	13.12	63.00	163.56	163.86	150.44	150.44	167.80
115.000	15400.00	5.05	16.62	63.00	167.06		150.44	150.44	167.80
115.000	17800.00	5.30	18.16	63.00	168.60	169.04	150.44	150.44	167.80
117.000	10400.00	4.40	13.18	63.00	163.82	164.12	150.64	150.64	168.00
117.000	15400.00	5.04	16.67	63.00	167.31		150.64	150.64	168.00
117.000	17800.00	5.28	18.20	63.00	168.84	169.27	150.64	150.64	168.00
119.000	10400.00	4.37	13.26	63.00	164.10		150.84	150.84	168.20
119.000	15400.00	5.01	16.76	63.00	167.60		150.84	150.84	168.20
119.000	17800.00	5.26	18.29	63.00	169.13		150.84	150.84	168.20
121.000	10400.00	4.35	13.31	63.00	164.35		151.04	151.04	168.40
121.000	15400.00	4.99	16.80	63.00	167.84		151.04	151.04	168.40
121.000	17800.00	5.25	18.33	63.00	169.37		151.04	151.04	168.40
123.000	10400.00	4.34	13.35	63.00	164.59		151.24	151.24	168.60
123.000	15400.00	4.98	16.84	63.00	168.08		151.24	151.24	168.60
123.000	17800.00	5.23	18.36	63.00	169.60		151.24	151.24	168.60
125.000	10400.00	4.32	13.39	63.00	164.83	165.12	151.44	151.44	168.80
125.000	15400.00	4.97	16.88	63.00	168.32		151.44	151.44	168.80
125.000	17800.00	5.22	18.40	63.00	169.84	170.26	151.44	151.44	168.80
127.000	10400.00	4.31	13.42	63.00	165.06	165.35	151.64	151.64	169.00
127.000	15400.00	4.96	16.92	63.00	168.56		151.64	151.64	169.00
127.000	17800.00	5.21	18.43	63.00	170.07	170.49	151.64	151.64	169.00
129.000	10400.00	4.30	13.46	63.00	165.30		151.84	151.84	169.20
129.000	15400.00	4.95	16.95	63.00	168.79		151.84	151.84	169.20
129.000	17800.00	5.20	18.47	63.00	170.31		151.84	151.84	169.20
130.000	10400.00	4.29	13.48	63.00	165.42		151.94	151.94	169.30
130.000	15400.00	4.94	16.97	63.00	168.91		151.94	151.94	169.30
130.000	17800.00	5.20	18.48	63.00	170.42		151.94	151.94	169.30

115,000	17800,00	5,30	18,16	63,00	168,60	150,44	150,44	167,80
117,000	10400,00	4,40	13,18	63,00	163,82	150,64	150,64	168,00
117,000	15400,00	5,04	16,67	63,00	167,31	150,64	150,64	168,00
117,000	17800,00	5,28	18,20	63,00	168,84	150,64	150,64	168,00
119,000	10400,00	4,37	13,26	63,00	164,10	150,84	150,84	168,20
119,000	15400,00	5,01	16,76	63,00	167,60	150,84	150,84	168,20
119,000	17800,00	5,26	18,29	63,00	169,13	150,84	150,84	168,20
121,000	10400,00	4,35	13,31	63,00	164,35	151,04	151,04	168,40
121,000	15400,00	4,99	16,80	63,00	167,84	151,04	151,04	168,40
121,000	17800,00	5,25	18,33	63,00	169,37	151,04	151,04	168,40
123,000	10400,00	4,34	13,35	63,00	164,59	151,24	151,24	168,60
123,000	15400,00	4,98	16,84	63,00	168,08	151,24	151,24	168,60
123,000	17800,00	5,23	18,36	63,00	169,60	151,24	151,24	168,60
125,000	10400,00	4,32	13,39	63,00	164,83	151,44	151,44	168,80
125,000	15400,00	4,97	16,88	63,00	168,32	151,44	151,44	168,80
125,000	17800,00	5,22	18,40	63,00	169,84	151,44	151,44	168,80
127,000	10400,00	4,31	13,42	63,00	165,06	151,64	151,64	169,00
127,000	15400,00	4,96	16,92	63,00	168,56	151,64	151,64	169,00
127,000	17800,00	5,21	18,43	63,00	170,07	151,64	151,64	169,00
129,000	10400,00	4,30	13,46	63,00	165,30	151,84	151,84	169,20
129,000	15400,00	4,95	16,95	63,00	168,79	151,84	151,84	169,20
129,000	17800,00	5,20	18,47	63,00	170,31	151,84	151,84	169,20
130,000	10400,00	4,29	13,48	63,00	165,42	151,94	151,94	169,30
130,000	15400,00	4,94	16,97	63,00	168,91	151,94	151,94	169,30
130,000	17800,00	5,20	18,48	63,00	170,42	151,94	151,94	169,30
131,000	10400,00	4,29	13,49	63,00	165,53	152,04	152,04	169,40
131,000	15400,00	4,94	16,99	63,00	169,03	152,04	152,04	169,40
131,000	17800,00	5,19	18,50	63,00	170,54	152,04	152,04	169,40
132,000	10400,00	4,28	13,51	63,00	165,65	152,14	152,14	169,50
132,000	15400,00	4,93	17,00	63,00	169,14	152,14	152,14	169,50
132,000	17800,00	5,19	18,51	63,00	170,65	152,14	152,14	169,50

JMMARY OF ERRORS

RUCTURE ANALSIS DONE

MARY PRINTOUT

SECNO	Q	VCH	DEPTH	K*XNCH	CWSEL		ELMIN	XLBEL	RBEL
132,830	10400,00	16,13	8,06	63,00	165,20		157,14	172,00	172,00
132,830	15400,00	18,39	10,47	63,00	167,61		157,14	172,00	172,00
132,830	17800,00	19,30	11,53	63,00	168,67		157,14	172,00	172,00
134,000	10400,00	4,16	12,57	63,00	169,79		157,22	172,00	172,00
134,000	15400,00	4,56	16,21	63,00	173,43		157,22	172,00	172,00
134,000	17800,00	4,72	17,81	63,00	175,03		157,22	172,00	172,00
135,000	10400,00	4,13	12,64	63,00	169,93	170.19	157,29	172,07	172,07
135,000	15400,00	4,54	16,26	63,00	173,55		157,29	172,07	172,07
135,000	17800,00	4,71	17,85	63,00	175,14	175.48	157,29	172,07	172,07
137,000	10400,00	4,08	12,76	63,00	170,19	170.45	157,43	172,21	172,21
137,000	15400,00	4,51	16,35	63,00	173,78		157,43	172,21	172,21
137,000	17800,00	4,68	17,93	63,00	175,36	175.70	157,43	172,21	172,21
138,000	10400,00	4,06	12,82	63,00	170,32		157,50	172,28	172,28
138,000	15400,00	4,50	16,40	63,00	173,90		157,50	172,28	172,28
138,000	17800,00	4,67	17,97	63,00	175,47		157,50	172,28	172,28
138,970	10400,00	4,04	12,88	63,00	170,45		157,57	172,35	172,35
138,970	15400,00	4,48	16,44	63,00	174,01		157,57	172,35	172,35
138,970	17800,00	4,66	18,01	63,00	175,58		157,57	172,35	172,35
139,550	10400,00	4,05	12,85	63,00	170,46		157,61	172,39	172,39
139,550	15400,00	4,49	16,41	63,00	174,02		157,61	172,39	172,39
139,550	17800,00	4,67	17,98	63,00	175,59		157,61	172,39	172,39
140,000	10400,00	4,04	12,88	63,00	170,52		157,64	172,42	172,42
140,000	15400,00	4,48	16,43	63,00	174,07		157,64	172,42	172,42
140,000	17800,00	4,66	18,00	63,00	175,64		157,64	172,42	172,42
142,000	10400,00	4,00	12,99	63,00	170,77		157,78	172,56	172,56
142,000	15400,00	4,46	16,52	63,00	174,30		157,78	172,56	172,56
142,000	17800,00	4,64	18,08	63,00	175,86		157,78	172,56	172,56

MMARY OF ERRORS

Sht 10

TRUCTURE ANALSIS DONE

MMARY PRINTOUT

SECNO	Q	VCH	DEPTH	K*XNCH	CWSEL	ELMIN	XLBEL	RBEL
142,830	10400,00	14,96	6,95	63,00	169,73	162,78	183,00	183,00
142,830	15400,00	17,07	9,02	63,00	171,80	162,78	183,00	183,00
142,830	17800,00	17,91	9,94	63,00	172,72	162,78	183,00	183,00
144,350	10400,00	4,98	11,10	63,00	173,98	162,88	182,00	185,00
144,350	15400,00	5,58	14,17	63,00	177,05	162,88	182,00	185,00
144,350	17800,00	5,80	15,53	63,00	178,41	162,88	182,00	185,00
145,540	10400,00	4,88	11,29	63,00	174,25	162,96	182,08	185,08
145,540	15400,00	5,50	14,35	63,00	177,31	162,96	182,08	185,08
145,540	17800,00	5,73	15,70	63,00	178,66	162,96	182,08	185,08
146,540	10400,00	4,82	11,43	63,00	174,46	163,03	182,15	185,15
146,540	15400,00	5,45	14,48	63,00	177,51	163,03	182,15	185,15
146,540	17800,00	5,68	15,83	63,00	178,86	163,03	182,15	185,15
147,150	10400,00	4,78	11,51	63,00	174,58	163,07	182,19	185,19
147,150	15400,00	5,41	14,56	63,00	177,63	163,07	182,19	185,19
147,150	17800,00	5,65	15,91	63,00	178,98	163,07	182,19	185,19
147,720	10400,00	4,51	11,57	35,00	174,68	163,11	185,50	187,00
147,720	15400,00	5,00	14,65	35,00	177,76	163,11	185,50	187,00
147,720	17800,00	5,19	16,00	35,00	179,11	163,11	185,50	187,00
148,550	10400,00	4,68	11,54	35,00	174,71	163,17	184,50	187,00
148,550	15400,00	5,32	14,60	35,00	177,77	163,17	184,50	187,00
148,550	17800,00	5,56	15,94	35,00	179,11	163,17	184,50	187,00
149,470	10400,00	4,24	11,60	35,00	174,83	163,23	184,00	187,00
149,470	15400,00	4,77	14,68	35,00	177,91	163,23	184,00	187,00
149,470	17800,00	4,97	16,03	35,00	179,26	163,23	184,00	187,00
150,570	10400,00	4,04	11,59	35,00	174,90	163,31	185,00	187,50
150,570	15400,00	4,62	14,67	35,00	177,98	163,31	185,00	187,50
150,570	17800,00	4,84	16,02	35,00	179,33	163,31	185,00	187,50
151,820	10400,00	3,83	11,58	35,00	174,98	163,40	184,00	288,00
151,820	15400,00	4,40	14,66	35,00	178,06	163,40	184,00	288,00
151,820	17800,00	4,63	16,01	35,00	179,41	163,40	184,00	288,00

LLAGAS CREEK — REACH V

1/29/82

Channel Stability Analysis

Evaluate for 100 yr flood

Reference: Design of Open Channel, Oct 1979 TR 25 P6.2

From Fig 6-1 evaluate method to be used for channel stability analysis

Assumptions

1. Assume channel is unstable
2. No significant sediment
3. The boundary materials are smaller th
4. The flow does not occur or at near design discharge for long periods
5. Boundary materials do not act as discrete particles
6. Use tractive power analysis

Design Data

$b = 160$

$z = 2$

$D_n = 17.15$ (Not D_h)

$n = .063$

$S = .001$

16.35 to 18.43

18800 to 17800

6.07 to 4.80

$Q = 18800$ cfs $V = 5.32$ (sta 32+00)

Ave. or "normal" values should not be used

P.I. = 23 (Average)

$D_{75} = .091$ mm (Average)

$D_{65} = .049$ mm (Average)

Unconfined Shearing strength = 296 psf

Data obtained from the profile & logs of test holes by SCS (Feb. 5 19

The worst channel sections would be near the reach

1 Unit 3 materials (Swampy deposits - black & gree silt clay & peat)

LAGAS CREEK – REACH 2

4/29/82
TJ

not a good reason use Fig 6-1 pg 6.2 TR25

Since $D_{75} < 6.35$ mm use tractive stress method

$\nu = 1.42 \times 10^{-5}$; $\rho = 1.94$ lb sec^2/ft^4

$$S_e = \frac{n^2 V^2}{(1.49)^2 R^{4/3}} \qquad R = \frac{3504}{246.68}$$

Use actual from SE WSP

$$= \frac{(.063)^2 (5.32)^2}{(1.49)^2 (34.4)} = .00147 \qquad = 14.20$$

$$\frac{V^3}{g \nu S_e} = \frac{(5.32)^3}{(32.2)(1.42\times10^{-5})(.00147)} = 2.24 \times 10$$

$$V/\sqrt{g k_s S_e} = 5.32 \Big/ \sqrt{(32.2)\,.00193/12\,(.00147)} = 1,928$$

From Fig 6-10 $V/\sqrt{\tau/\rho} = 27.5$

$$\tau = V^2\rho / \left(V\sqrt{\tau/\rho}\right)^2 = (5.32)^2\, 1.94 / (27.5)^2 = .07$$

$\frac{b}{D} = \frac{170}{17.15} = 9.91$ $\quad \tau_s/\tau = 0.78$ sides

Channel bed $\tau_b/\tau = .99$ ← Wrong Fig for Tractive Power

$\tau_s = .067 \times 0.78 = 0.052$

$\tau_b = .067 \times 0.99 = 0.066$

Use Fig 6-13 & 6-1 pg 6-25 TR25

Tractive Power $\tau_b V = (.066)(5.15) = 0.35$ lb/ft^2

Actual tractive Power

Average shear strength for M.H. Material 296 psf

From Design of Open Channels TR25 Fig 6-15

The erosive resistance of the material in channel boundary falls into non-erosive area

∴ channel is stable

Since the velocity for unit 3 material is O.K., Unit 4 & 5 should be OK check no further

P.S. shear strength for unit 4 varies from 475–

LLAGAS CREEK - REACH 2 — TY 2/29/82

Check stability for 10yr flow

Tractive power method can not be used for the 10-year frequency because of the b/d ratio. Not true - Use Fig 6.

Try allowable Velocity approach (Between sta 22+00 and station 95+00)

From field investigation on Reach 1, it is reasonable to assume that flows have a stable concentration of Less than 1000ppm. The channel is straight and has no bed material load.

Reference TR25 Fig 2. $D_{95} < 2$ mm sediment free flow.

The channel is to be excavated into a M.H and CH soil with an average plasticity Index of 23

Basic Velocity, $V_b = 3.5$ fps Fig 6-2 TR25

D_n = 12' ave (10% flow) Depth correction $D = 1.24$

Density Correction, compute e void ratio
use boring log 107-1 $\gamma_d = 99.5$, $G = 2.75$

$$e = G_1 \frac{\gamma_w}{\gamma_d} - 1 = (2.76)\frac{62.4}{99.5} - 1 = 0.72$$

$C_e = 1.11$ Fig 6-2 TR25

Frequency correction $F = 1.0$

$$V_a = (V_b)(D)(C_e)(F) = 3.5 \times 1.29 \times 1.11 = 5.01 \text{ fps}$$

Actual V = 4.07 to 5.97

$V_{design} = 5_{ave}$ V_a allowable

Since V_{design} is almost equal $V_{allowable}$, Seeding or rock lining may

LLAGAS CREEK – REACH 2 — 1/29/8 TJ

Between station 96+00 and Pacheco Pass Highway for 10 year frequency

Data $V = 5.5$ Actual V = 4.87 to 6.06

$D_{design} = 11'$ (sta 130+00)

≈ 9.92 from WSP

Use Boring log #110 as typical

$G_7 = 2.82$

$\gamma_{dry} = 100$ unit 5 material

P.I. = 12

$D_{75} = .06$

The channel to be excavated into a SC & CL soil with P.I. of 12

$D_{75} < 2$ mm sediment free flow

$V_b = 2.80$ Depth correction $D = 1.25$

Density Correction

$$e = 2.82 \frac{62.4}{100} - 1 = 0.76$$

$C_e = 1.05$

$V_a = 2.80 \times 1.25 \times 1.05 = 3.68 \not\leq V_{design}$ N.G.

The allowable velocity is exceeded by the 10% Chance flow velocity.

After construction the channel should be protected with an armor (hydro-seeding or rock lining). It will be verified by the supplemental soils report in the final

Structural Design

Design Parameters For Concrete Elements

A) Soil

ϕ = angle of internal friction of the soil

K_a = Coefficient of active pressure

$= \frac{1+\sin\phi}{1-\sin\phi}$ (Level Backfill)

γ_{wet} = Unit Wt. of soil

$\gamma_{sub} = \left(\frac{G_s - 1}{1+e}\right)\gamma_w$

e = void ratio

G_s = Specific Gra
= 2.6 Assum

B) Concrete

1) Reinforcing steel —

f_s = 20,000 psi (NEH section 6 Allowable stress in Reinforcement ES1605ht1.

f_y = 40000 psi (yield strength, Grade 40 ASTM 615

2) Concrete

f'_c = 4000 psi for standard types and siz of structure NEH section P 6.4.1

$f_c = 0.40 f'_c$ = 1600 psi p.6.4.

6) Clearence — ACI 318 NEH 6 6.4.2

Unless noted otherwise, use the following clearence

Cast against earth	3"
exposed	2"

7) Shrinkage and Temp. Reinforcement: $p = \frac{A_s}{bd}$ — NEH 6 6.4.2

Slabs $p_s = .002$ exposed face & $p_s = 0.001$ unexposed face — ACI 318-

Wall – Horiz Reinf $p_s = .0025$ — ACI 318-

ACI sect 14.2f

~~Vert Reinf $p_s = .0015$~~ — ACI 318-7

USE NEH 6 or TR-67 ~~ACI 10.16.2 & 14.2f~~

Max bar spacing 18" — NEH 6 6.4.2

8) $n = \frac{E_s}{E_c} = 8$ — For Wes states SCS

$a = 1.44$

$j = 0.870$ $\quad j = 1 - \frac{1}{3}k$

$k = .390$

$K = 272$ $\quad k = \frac{1}{1 + f_s/nf_c}$

$M = A_s a d$ $\quad K = \frac{f_c}{2} k j$

$a = \frac{f_s}{1200}$ (neg-value)

3) Shear strength.

V_c = Beam – shears at a distance [d] from the face of support: Beams w/ no web reinforcement $= 1.1\sqrt{f'_c} = 70$ psi

NEH 6 ES-16.

4) Development of Reinforcement, l_d

Bar #	l_d min
#4	8"
#5	10"
#6	14"
#7	18"
#8	24"
#9	30"
#10	37"
#11	44"

NEH 6 ES-16. P. 3-31

3-3-82 USE notice 6-4 to NEH-6 CKD

5) Splices length

Bar #	Splice length
#3	12"
#4	15"
#5	19"
#6	23"
#7	27"
#8	31"
#9	40"
#10	49"

NEH 6 ES-16. P3-3

LLAGAS CREEK—REACH 2

PRELIMINARY COST ESTIMATE

NO.	ITEMS OF WORK	QUANTITY	ESTIMATED COST	
			UNIT PRICE	$
1	Mobilization		Lump Sum	362,000
2	Clearing And Grubbing		L. S.	124,200
3	Maintenance And Clean Up		L. S.	121,000
4	Control Of Water		L. S.	181,000
5	Channel Embankment	372,000 (C.Y.)	$ 1.25/c.y.	465,000
6	Disposal Of Excess Excavated Material	1,028,600 (C.Y.)	$ 2.30/c.y.	2,365,780
7	Structural Concrete	1800 (C.Y.)	$ 300/c.y.	540,000
8	Rock Lining	51,755 (C.Y.)	$ 36/c.y.	1,864,000
9	Farm Bridge Construction		L.S.	172,800
10	Drainage Inlets	12 Ea.	$ 7,500/ea.	96,000
11	Planting And Maintenance		L. S.	410,600

Total Project Cost $ 6,702,380

Total Project Cost Use $ 6,703,000

Note: Based On 1982 Prices

Santa Clara Valley Water District — Earth Quantity Estimate

EARTH COMPUTATION SHEET
FC 507 (01-14-77)

Date: 1/28/82

Project: LLAGAS CREEK REACH 2

Computed By: TJ

Planimeter Number:

Station	Distance	CUT End Area	CUT Average	CUT Cubic Yards	FILL End Area	FILL Average	FILL Cubic Yards
22+00		2002			791		
	238		2002	17,647		791	6,973
24+38		2002			791		
	262		1581	15,342		1222	11,853
27+00		1160			1652		
	1000		1204	44,593		1677	62093
37+00		1248			1701		
	1000		1309	48,481		1651	61,130
47+00		1369			1600		
	200		1436	10633		1607	11,900
49+00		1502			1613		
	300		1583	17,589		1671	18,567
52+00		1664			1729		
	200		1664	12,326		1729	12807
54+00		1664			1729		
	400		1721	25,489		1729	25,615
58+00		1,777			1729		
	300		1985	22,050		1,651	18,339
61+00		2192			1572		
	300		2437	27,078		1323	14,694
64+00		2682			1073		
	700		2,682	69,533		1035	26,833
71+00		2682			997		
	600		2802	62,267		803	17,833
77+00		2922			608		
	344		2922	31,228		608	7746
Total				410,256 cu. yd.			296,383 cu. yd.

Sht 1

Santa Clara Valley Water District

EARTH COMPUTATION SHEET

FC 507 (01-14-77)

Date:

Project:	Computed By:	Planimeter Number:

Station	Distance	CUT End Area	CUT Average	CUT Cubic Yards	FILL End Area	FILL Average	FILL Cubic Yards
80+44		2922			608		
	245		3,529	38,018		349	3,162
82+89		4135			89		
	478		4287	75,896		138	2,443
87+67		4439			187		
	300		3996	44,394		69	1039
90+67		3552			0		
	697		3215	82,995		113	2904
97+64		2878			225		
	600		3,164	70,311		120	2,667
103+64		3,450			15		
	576		3,406	72,651		8	171
109+40		3361			0		
	397		3,661	53,830			
113+37		3961			0		
	1168		4116	178,055			
125+05		4271			0		
	160		4,396	26,050			
126+65		4521			0		
	297		4822	53,037			
129+62		5122			0		
	238		5122	45,150			
132+00		5122			0		
	100		5582	29,674			
133+00		6042			0		
	655		5582	135,415			
Total				888,476 cu. yd.			12386 cu. yd.

Santa Clara Valley Water District

EARTH COMPUTATION SHEET

FC 507 (01-14-77)

Date

Project:	Computed By:	Planimeter Number:

Station	Distance	CUT End Area	CUT Average	CUT Cubic Yards	FILL End Area	FILL Average	FILL Cubic Yards
139+55		5122			0		
	257		5240	49,872			
142+12		5357			0		
	54		3285	6569			
142+66		1212			0		
	288		1,212	12,928			
145+54		1212			0		
	218		1216	9818			
147+72		1220			0		
	410		1384	21,016		29	440
151+82		1548			58		
	58		774	1663		29	62
152+40		0			0		

Total	101,866 cu. yd.	502 cu. yd.

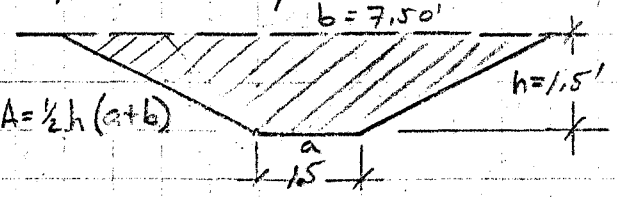
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Planimeter Reading Sq. ft = $R_{1\,Ave} \times 10' \times 20'$ SHT. 1

STATION		R1	R2	Ave.	SF
24+38	R	3.72	7.41	3.705	741
	L	6.32	12.61	6.305	1,261
					2,002 SF
27+00		5.79	11.60	5.80	1,160 SF
37+00		6.19	12.48	6.24	1,248 SF
47+00		6.82	13.69	6.85	1,369 SF
49+00	~~R1 7.37~~	R2 13.75	>7.47		
	R4 28.63	R3 21.22	Ave = 7.44		1,488 SF
	7.41				

Typical Drainage Ditch Excavation



A_L = 6.75 sf
A_R = 6.75 sf
1,502 sf*

	R1	R2	Ave.	SF
R	3.50	7.02	3.51	702 SF
L	4.57	9.11	4.56	911 SF
				1,613 SF

54+00	8.28	16.50	8.25	1,650 sf	
plus 2 - Drainage Ditches				13.50 sf	
				1,664 SF*	

R	3.19	6.37	3.19	637 SF
L	5.42	10.92	5.46	1,092 SF
				1,729 SF

*Values Rounded to nearest whole number

Sq. Ft. = Ave. × 10' × 20'

SHT. 2

STATION	CUT R1	CUT R2	CUT Ave.	CUT SF	FILL	FILL R1	FILL R2	FILL Ave.	FILL SF
58+00	8.89	17.77	8.89	1,777 SF	R	3.43	6.80	3.40	680 SF
					L	5.22	10.49	5.25	1,049 SF
									1,729 SF
61+00	10.99	21.92	10.96	2,192 SF	R	2.99	5.94	2.97	594 SF
					L	4.89	9.78	4.89	978 SF
									1,572 SF
64+00	R1 13.42	R2 26.74 (13.37)	13.41	2,682 SF	R	3.18	6.34	3.17	634 SF
	13.45	R3 40.19			L	~~R1 2.30~~ 2.19	R2 4.49	2.20	439 SF
							R3 6.69		1,073 SF
71+00	R1 ~~13.13~~	R2 26.55 (13.42)	13.41	2,682 SF	R	1.53	3.04	1.52	304 SF
	R3 39.94	13.39			L	R1 3.45	R2 6.50	3.48	693 SF
						~~3.06~~	R3 9.98		997 SF
77+00	14.63	29.22	14.61	2,922 SF	R	1.23	2.50	1.25	250 SF
					L	1.78	3.58	1.79	358 SF
									608 SF
82+89	~~R1 26.74~~	R2 41.41 (20.67)	20.68	4,135 SF	R	0.47	0.89	0.45	89 SF
	R3 62.09	20.68							
87+67	R 12.65	12.66	12.66	2,531 SF	R	0.95	1.87	0.94	187 SF
	L 9.53	19.07	9.54	1,908 SF					
				4,439 SF					

Sq. ft = $R_{1\,Ave.}$ x 10' x 20'

	CUT				FILL			
STATION	R1	R2	Ave.	SF	R1	R2	Ave.	SF
90+67	R ~~12.12~~ 12.05	24.17	12.06	2,412 SF	NO FILL SHOWN @ XSEC. 90+67			
	R3 12.07							
	L 5.70	11.40	5.70	1,140 SF				
				3,552 SF				
97+64	14.38	28.78	14.39	2,878 SF	R 0.75	1.49	0.75	149 SF
					L 0.38	0.76	0.38	76 SF
								225 SF
103+64	~~R1 17.16~~				R 0.07	0.15	0.08	15 SF
	R2 17.23							
	R3 34.50	17.27	Ave. 17.25	3,450 SF				
109+40	R 10.47	20.91	10.46	2,091 SF	NO FILL SHOWN @ XSEC. 109+40			
	L 6.34	12.69	6.35	1,270 SF				
				3,361 SF				
113+37	R 11.16	22.28	11.14	2,228 SF	NO FILL SHOWN @ XSEC. 113+37			
	L 8.69	17.33	8.67	1,733 SF				
				3,961 SF				
125+05	R 12.90	25.95	12.98	2,595 SF	NO FILL SHOWN @ XSEC. 125+05			
	L 8.40	16.76	8.38	1,676 SF				
				4,271 SF				
126+65	R 14.28	28.58	14.29	2,858 SF	NO FILL SHOWN @ XSEC 126+65			
	L 8.32	16.63	8.32	1,663 SF				
				4,521 SF				

1-4-80

LLAGAS CREEK — REACH 2

Cost estimate items will be broken down as follows:

Items of Work

1. Mobilization
2. Clearing & Grubbing
3. Maintenance and clean up
4. Control of Water
5. Structure removal
6. Channel excavation
7. Channel embankment
8. Structural excavation
9. Structural Backfill
10. Structural Concrete
11. Drainage inlets
12. Rock lining
13. Sacked rip-rap
14. Farm Bridge construction (Local Cost)
15. Relocation of Existing facilities (Local Cost)
16. Disposal of earth material
17. Planting

Sq. Ft. = $R_{ave.}$ x 10' x 20' SHT. 4

R STATION	CUT R1	R2	Ave	SF	FILL R1	R2	Ave,	SF
~~129+62~~ 132+00	R 13.69	27.32	13.66	2,732 SF	No Fill shown @ Xsec 132+00			
	L R1 11.94	~~R2 23.34~~ 23.40 R3 11.96	11.95	2,390 SF				
				5,122 SF				
Plus 2 Drainage Dikes @ 6.75 SF ea.				5,122 SF + 13.50 SF				
			(Rounded OFF) →	5,136 SF				
~~139+55~~ 142+00	R 13.25	26.49	13.25	2,649 SF	No Fill shown @ XSEC 142+00			
	L 12.34	24.73	12.37	2,473 SF				
				5,122 SF				
15+00	R 3.15	6.30	3.15	630 SF	No Fill shown @ XSEC 15+00			
(145+54) SHT. 2a	L ~~R1 2.75~~ 2.91	~~R2 5.69~~ R3 2.90	Ave. 2.91	582 SF				
				1,212 SF				
17+18	R 2.65	5.30	2.65	530 SF	No Fill shown @ XSEC 17+18			
(147+72) SHT. 4a	L R1 3.43	R2 6.80 ~~3.57~~ R3 3.47	Ave. 3.45	690 SF				
				1,220 SF				
21+51	R 6.34	12.69	6.35	1,270 SF	L 0.29	0.58	0.29	58 SF
(151+82) SHT. 5a	L 1.39	2.78	1.39	278 SF	(Fill left of E only)			
				1,548 SF				

On Shts. 1, 2, & 3 both R & other stationing (penciled in) were used to position X sections.

LLAGAS CREEK - REACH 2 3/10/89

Bid
item 1 → item 4

add 11 % For Mobilization, Maintenance, cleanup, ', Control of water

item 1 Mobilization 6 % of other items of work
6p28,380 x .08 = $361,703
use $ 362,000

item 2 Clearing and Grubbing Corp use $2000/ac
15% inflation $2000 x 1.15 = $2300/ac
12,300 x 54 ac = $124,200

item 3 Maintenance and Clean up 2% of other items of work
6,028,380 x .02 = 120,567, use 121,0

item 4 Control of water 3% of other items of work 6,028,380 x .03 = 180,857
use $ 181,000

5) CHANNEL EMBANKMENT

SCOPE OF WORKS (MATERIAL USE FOR CONSTRUCTION OF LEV

1. EXCAVATING EARTH MATERIAL
2. TRANSPORTING EARTH MATERIAL
3. EXCAVATION FOR DITCHES
4. PLACING EARTH MATERIAL
5. MISC. DRAINAGE GRADING
6. CONSTRUCTION OF EMBANKMENT INC. LEVEE
7. Compaction

Total Embankment quantity 309,271 C.Y use 310,000

add 20% for shrinkage

∴ total Embankment = 310,000 × 1.20 = 372,000

From past water District project
Embankment unit cost $1.25/c.y.

372000 × 1.25 = 465,000

per discussion w/ OTG & WF. CKD 3-3-82

- We need to look for ways to provide for more on site disposal
- We need to assure that S. haul distances are a minimum.
- Documentation is needed to show overhaul is cheaper than purchasing a waste disposal site or right to fill adjacent properties.

6) DISPOSAL OF EXCESS EXCAVATED MATERIAL

Disposal of Excess Material = 1,400,600 − 372,000 = 1,028,600

ASSUME PRODUCTION RATE 6,000 C.Y DAY

OF DAYS REQUIRED $\frac{1,028,600 \text{ CY}}{6,000 \text{ C.Y/DAY}}$ = 257 DAYS

ASSUMPTIONS

1) 20 CU YD TRUCKS
2) 17 TRUCKS
3) 10 MILE ROUND TRIP
4) 40 MIN round trip

OF TRIPS = $\frac{6000 \text{ CY/DAY}}{20 \text{ CY/TRIP}}$ = 300 TRIPS/DAY

OF TRIPS/TRUCK = $\frac{300 \text{ TRIPS/DAY}}{17 \text{ TRUCKS}}$ = 17.64 TRIPS/DAY/TRUCK

OF MINUTES/TRIP $\frac{(60 \text{ MIN/DAY})(8 \text{ HRS/DAY})}{17.64 \text{ TRIPS/DAY}} = \frac{27.2 \text{ MIN}}{\text{TRIP}}$

Equipment

EQUIPTMENT RENTAL RATE FOR 18-20 C.Y 5 AXLE DUMP TRUCK & TRAILERS #416/day $52/hr including labor, eg. P & O.

17 × 416/DAY = $7,072/day

2 5 C.Y LOADERS 440/DAY

2 × 440/DAY = $880/day

1 GRADER 19(T) 325 DAY $325/day

1 WATER TRUCK 320 DAY $320/day

$8,597/DAY

8,597/day × 257 days ≈ $2,209,429

Cost/C.Y = $\frac{\$2,210,000}{1,028,600}$ = $2.15/C.Y.

Unit cost from Corp of Engineers for Livas Creek Levee Project = $2/C.Y 1980 min.

LLAGAS CREEK — REACH 2

increase by 15% $2/C.T. x 1.15 = $2.3/c.y. used.

Total excavation

1,025,600 x $2.3/c.y. = $2,365,780

LLAGAS CREEK REACH 2 COST ESTIMATE

7) STRUCTURAL CONCRETE FOR DROP STRUCTURE

STILLING BASIN, CUTOFF WALLS, & CHUTE SURFACE $\frac{76.1\ FT^3/FT\ WIDTH}{27\ FT^3/YD^3} \times 90'_{AVE} = 253\ Y.$

SIDE WALLS $2 \times 1,318\ FT^2 \times 1.5\ FT / 27\ FT^3/YD^3 = 146.5$

HEAD WALLS $2 \times 792\ FT^2 \times 1.5\ FT / 27\ FT^3/YD^3 = 88\ Y$

WING WALLS $2 \times 1714\ FT^2 \times .75\ FT / 27\ FT^3/YD^3 = 95\ Y$

583 YD
USE 600

TOTAL STRUCTURAL CONCRETE FOR three DROP STRUCTURES
$600 \times 3 = 1800\ C.Y.$

COST $1800\ YD^3 \times 300/YD^3 = \$\ 540,000$

$300/yd^3 includes structural excavation and backfill, filter drain material etc.
The average bids the District received is $275/C.Y. $300 should be O.K.

8) RIPRAP LINING - SURROUNDING DROP STRUCTURE

CHANNEL SIDES $2\left(\frac{35.8\ FT \times 1.5\ FT \times 123\ FT}{27\ FT^3/YD^3}\right) = 490$

CHANNEL BOTTOM (UPSTREAM) $\frac{100\ FT \times 1.5\ FT \times 160\ FT}{27\ FT^3/YD^3} = 889\ Y$

CHANNEL BOTTOM (DOWNSTREAM) $\frac{(3680\ FT^2 + 6240\ FT^2 + 1040\ FT^2)\ 1.5\ FT}{27\ FT^3/YD^3} = 609\ Y$

1987 Y

COST $1987\ YD^3 \times 3$ drop structures $= 5961\ C.Y.$

Rock lining in the backslope of Reach 1
use Class facing Rock
$30' \times 1200 \times 1.5 \times 2 \times \frac{1}{27} = 4000\ C.Y.$
side slope $12000 \times 20 \times 1.5 \times \frac{1}{27} = 13333$
Outfall at Miller slough & Exist LLAGAS CRK
$2 \times 100 \times 100 \times 1.5 \times \frac{1}{27} = 1111\ C.Y.$
Total Rock $= 24,405\ C.Y.$
20% Contg. $4,881\ C.Y.$
$29,286\ C.Y.$

*Note The rock lining on the channel slope was not included in the preliminary estimate. Rock lining may be required at certain locations. It will be verified by a supplemental soil investigation before the completion of the final phase of design

In the preliminary design, rocking lining will be provided between sta 118+00 and 140+00 (Non cohesive material From 1979 Engineering append.)

$Q_{10\%} = 10400 \quad n = .025 \quad S = .001$

$$K' = \frac{Qn}{S^{1/2} b^{8/3}} = \frac{(10400)(.025)}{(.001)^{1/2}(165)^{8/3}} = \frac{260}{(.032)(8190.10)} = .01$$

$\frac{D}{b} = .05 \quad D = 8.25$ use 8.5

$$A = \left[\sqrt{2D^2 + D^2}\right] 1.5$$

$$= \left[\sqrt{2^2 (8.5)^2 + 8.5^2}\right] 1.5 = 51.38 \text{ C.F/l.f}$$

Total Rock lining $= 51.38 \times 11{,}800 \times \frac{1}{27} = 22455$

Total rock lining $22455 + 29300 = 51755$ C.Y.

$51755 \times \frac{36}{\text{C.Y.}} = \$1{,}863{,}180$ use $1{,}864{,}000$

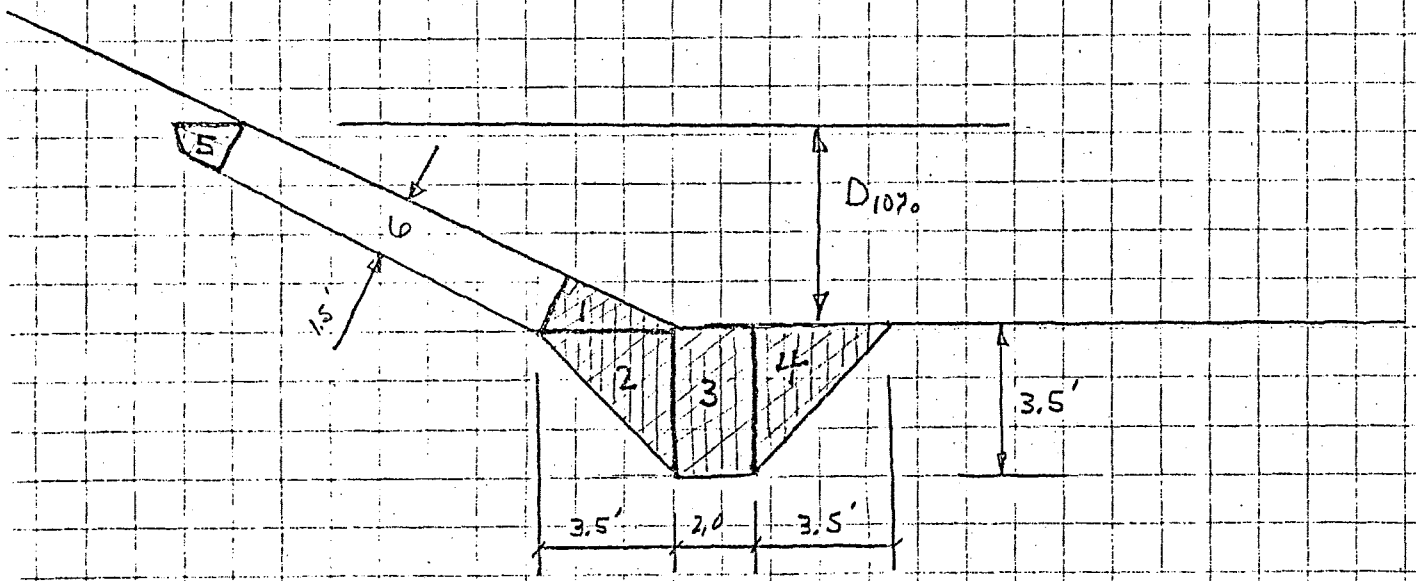
RIPRAP CALCS.

11/80

① determine $d_{n\,10\%}$ → Given: $Q_{10\%}$, b, S, n

S.F. of rock lining for one bank

$= \left[\sqrt{(2)^2 d_{10\%}^2 + d_{10\%}^2}\right](1.5) + 22.87$



① $A_1 = (3.16)(1.5)\frac{1}{2} = 2.37$ s.f.

② $A_2 = \frac{1}{2}(3.5)^2 = 6.13$ s.f.

③ $A_3 = (2.0)(3.5) = 7.00$ sf

④ $A_4 = \frac{1}{2}(3.5)^2 = 6.13$ sf

⑤ $A_5 = 1.24$ sf

22.87 s.f.

⑥ $A_6 = \left[\sqrt{2D_{10\%}^2 + D_{10\%}^2}\right] 1.5$

9) FARM BRIDGE CONSTRUCTION

BRIDGE SPAN ~ 240 FT

BRIDGE WIDTH ~ 15 FT ROAD + 3FT RAIL

BRIDGE TYPE T-BEAM OR slab bridge

ESTIMATED COST / FT^2 $80

TOTAL COST $(15+3\text{ft})(240\text{ft})(40\$/\text{ft}^2) = \$172,800$

1-4-79

LLAGAS CREEK – REACH 2

J

10) Drainage Inlets 12 ea

Cost/inlet		
72" CMP – 12'	@ $121/l.f.	$ 1457
36" Flap gate	$1,700	$ 1,700
48 slide gate	$1,800	$ 1,800
Sacked rip rap		$ 1,000
Concrete inlet		$ 200
36" CMP × 40'		$ 800
Labor: 3 men day/inlet		
3 × 8 × 24 $/hr		$ 768
CRANE: 1 HOUR / INLET		$ 30
		7,550

use $8000/inlet 12 INLETS TOTAL COST 12 @ 8000 = 96,000

LIAGAS CREEK – REACH 2

11) Cost Estimate for irrigation System
(The only source of Water is from the Girloy treatment p
Estimated length of Pipe 27,000 l.f of pvc

Assume 3 trees/cluster
800 Clusters 10' pvc/cluster
∴ 800 × 10 = 8000 l.f of pvc

3"	15000 lf. @	$225/100'
2½"	4000 lf. @	$188/100'
2"	2000 lf @	$118/100'
1½"	2000 lf @	$88/100'
1"	2000 lf @	$59/100'
¾"	2000 lf @	$40/100'
½"	5000 lf @	$30/100'

Total Cost $48870

Sprinkler heads @$2.5/ea × 1500 = $3750

Labor
installation rate 1000'/day days req = 32000/1000 = 32 days

2 men @ $24/hr	24×8×32×2	= $12,288
Superint.	32×$200/day	= $6400
Equip	$120/day × 32	= $3840
Connection & testing		$5000
		$80,148
(P&O)	Add 25% Contig.	20,037
		$100,185
Booster Pump may be req.		15,000
Total cost for irrigation sys. =		$115,185

Chlorine concentration in the treated water may be too high for irrigation. Construction new underground well and installation of new pumping facility may be req. cost is about $100,000

per discussion w/ DPG, WF • SCS will provide LANDSCAPE DESIGN • DO NOT DO ANY MORE WORK ON THIS. THERE IS NO BASIS FOR PROVIDING PLANTING OF THIS DENSITY OF 15 gal SIZE!

LLAGAS CREEK – REACH 2

Assume the irrigation for the plants will be done by Water t
(35/hr) @ $280/day for the first 2 years, $350/day for the 3rd & 4TH ye

First 2 years

Between May and Oct. plants will be irrigated once a week. days required = 26 X 2 = 52 day

From Nov. Till April plants will be irrigated at least once every two weeks, days required
= 52 x 1/2 = 26

Total Cost (52+26) X 280 = $21,840

3rd & 4TH year

Between May and Oct plants will be irrigated once every 2 weeks days req = 26 days

From Nov Till April plants will be irrigated at least once a month days req = 13 days

Total Cost (26+13) X 322 = $12,558

Grass & Weed Control 4 times a year

Approx Area to be cleared

$53 X 11700 X 2 X \frac{1}{43560} = 28.5$ Ac. ±

Chemical treatment
(Roundup Herbicide)
1 gal of Roundup covers 2 Ac.

1st year	Cost	$70/gal X 15gal X 4	= $4,200
2nd year	Cost	$80.5/gal X 15gal X 4	= $4830
3rd year	Cost	$93/gal X 15gal X 4	= $5580
4th year	Cost	$107/gal X 15gal X 4	= $6420
			$21,030

1st 2 yr	Spray truck 35/hr X 8X 8	= $ 2240
3rd & 4TH	Spray truck 44/hr X 8X 8	= $ 2816
	Total Maint Cost for 4 yrs	$ 60484
	add 15% Contig	9073
	use $70,000	69,557

LLAGAS CREEK – REACH 2

y

1) Planting

There will be 2,500 plants (trees & shrubs to be planted on reach 2.

1900 trees (24" box tree or 15 gal)
600 shrubs (5 gals)

Cost/tree

Backfill mix 1 c.y./tree @ $13/c.y. = $13
Misc Hem & Guy Wire, = $15
labor: 4 men day, plant 20 trees/day
days req = 1900/20 = 95 days
laborers @ $24/hr including Profit & overh

labor Cost/tree = (4 × 95 × 8 × 24)/1900 = $ 38/tree

Equipment 1 backhoe & Loader for 95 days @ $45/hr.
cost/tree = (95 × 8 × 45)/1900 = $18/tree

Ave cost of 15 gal tree = $80/tree
Total Cost/tree = $164/tree

Total cost for 1900 tree × 164 = 311,600

600 shrubs (1 gal & 5 gal)
cost/shrub = $10/shrub (Ave)
labor 2 men plant 32 plants/day
days Req = 600/32 = 19 days
labor Cost/tree = (19 × 8 × 24 × 4)/600 = $24/shru
Equipment 14" Earth Auger @ $36/hr
cost/shrub = (19 × 36 × 8)/600 = $9/shrub
Backfill mix & Misc = $57/shrub
Total Cost/shrub = $45/shrub

Total Cost $45 × 600 = $27,000
Total cost for planting $338,600

LLAGAS CREEK

Total cost = Planting + Maintenance
= 338600 + 72000
= $410,600

DATA AND REFERENCES

1. Erosion

   A. Data: Shear strengths were determined from the shear tests and Vane Shear Tests.

   B. Reference

      a) August 17, 1973 - State Geologist, E. E. Stearns to Soil Conservation Service (Portland Office). The soil report consists of a revised profile and log of test holes for Llagas Creek from the Pajaro River to Pacheco Pass Highway.

      b) Technical Release No. 25, Chapter G, Planning and Design of Open Channel, Soil Conservation Service, was used for tractive power analysis for the 100-year flow.

2. Freeboard and Other Miscellaneous Hydraulic Design Criteria

   References

   a) Engineering Design Standard - Far West State, Soil Conservation Service

   b) Technical Release No. 25, Planning and Design of Open Channel, Soil Conservation Service.

3. Roughness Coefficients

   References

   a) Engineering Design Standard - Far West State, Soil Conservation Service

   b) Technical Release No. 25, Planning and Design of Open Channel, Soil Conservation Service

   c) Engineering Handbook - Section 5, Hydraulics Supplement B, Soil Conservation Service.

   d) In accordance with the meeting held on October 16, 1979 between District staff and Soil Conservation Service personnel, it was decided the "n" value of .063 for 100-year flow, .025 for the 10-year flow should be used.

4. Drop Structures

Reference

Engineering Handbook, Section 14, Chute Spillways and SAF Stilling Basin Drop Structures were found to be the most applicable type.

5. Hydraulic Configuration

A. Data

a) Cross sections taken by Santa Clara Valley Water District office.

b) Design flow rate

B. Reference

a) HEC-2 Water Surface Profiles Program, U. S. Army Corps of Engineers, April 1971.

b) Llagas Creek Engineering Appendix to Work Plan Supplement, U.S.D.A., S.C.S., February 1982 Final.

6. Hydrology

Reference

Hydrology Appendix, Llagas Creek Watershed Projects, February 1982 by Soil Conservation Service.